RARE

Philipson, John

◆

Carriages-

1889

Exhibit

TS
2020
.P555

US PATENT & TRADEMARK OFFICE
3 0402 00130 4221

534

SCIENTIFIC LIBRARY

UNITED STATES PATENT AND

TRADEMARK OFFICE

LIBRARY
DEC 1 1980
U. S. PATENT OFFICE

REPORTS

ON THE

CARRIAGES

IN THE

PARIS EXHIBITION,

1889.

BY

ARTISAN REPORTERS,

Selected for the duty by the Institute of British Carriage Manufacturers.

EDITED AND REVISED BY

JOHN PHILIPSON, J.P., M.I.M.E.,

A Vice-president of the Institute;
Member of the Livery of the Worshipful Company of Coachmakers and Coach Harness Makers of London;
Hon. Life-Member of the Carriage Makers' National Association of the United States.

LONDON:
JOHN KEMP AND CO., 46, CANNON STREET, E.C.
NEWCASTLE-UPON-TYNE: MAWSON, SWAN, AND MORGAN.

TS
2020
.P555

PRINTED BY JOHN KEMP AND CO.,
ASPLEY GUISE, BEDFORDSHIRE.

LIBRARY
DEC 1 1930
26875
U. S. PATENT OFFICE

CONTENTS.

Introduction, by Jno. Philipson ... . i-viii

A Review of Carriages, by John S. Foggett, one of the staff of Messrs. Atkinson and Philipson, Newcastle-upon-Tyne *3-34*

Artisans' Report on Carriage Trimming, by Edward Evans, one of the staff of Messrs. Worger and Co., London *36-48*

A description of Springs and Axles, by Jno. Philipson *49-76*

Carriages, by W. Gardiner, delegate from the Dublin Coachmakers *78-83*

Technology of Carriage Building *84*

THIS VOLUME OF REPORTS IS DEDICATED BY THE EDITOR
TO
GEORGE NORGATE HOOPER, ESQ., F.R.G.S., F.S.S.,
PRESIDENT OF THE INSTITUTE OF
BRITISH CARRIAGE MANUFACTURERS;
MEMBER OF THE COUNCIL OF THE LONDON CHAMBER OF COMMERCE;
AS A MARK OF PERSONAL ESTEEM,
AND IN RECOGNITION OF HIS ARDUOUS AND SELF-DENYING
LABOURS FOR THE ADVANCEMENT OF THE
ART OF COACHBUILDING.

PREFACE.

THE Paris International Exhibition of 1889 may be regarded as the full development of an institution, which, during the last century, has done much for the advancement of arts and manufactures in France.

One of the contributors to this volume has pointed out that the French did not originate exhibitions as is popularly supposed, but they, more than any other people, have availed themselves of exhibitions for the purpose of giving stimulus to their native industries.

The first exhibition in France—that of 1798—arose out of the depressed condition of certain manufactures, those of china, tapestries, and carpets, and so great was its success that it was resolved to hold one every year. That determination, however, was not adhered to.

From the first the French appear to have been inspired with a strong and somewhat unreasoning antagonism to British products, for at the period referred to it was decided that a gold medal should be awarded to anyone who showed the most formidable opposition to British manufactures. It is nearly 100 years since that offer was made, and 50 years later we find the French persisting in the mistaken policy of excluding other nations from their competitions. Wiser councils prevailed after 1849 and the French adopted the idea which we had carried out with so much success, viz., that of inviting other nations to contribute, so that we might make ourselves acquainted with the capabilities of our competitors.

British coachmakers, who figured at the exhibition of 1889, had reason to believe that the old spirit of opposition to English manufactures still exists, inasmuch as they were treated most unjustly in the matter of position.

While their French and Belgian rivals occupied buildings, which were handsomely decorated and fitted to give the best effect of light and shade, the British carriage manufacturers were crowded up into a dark and dirty corner, where the vehicles could only be seen under the most disadvantageous condition, and where they were absolutely damaged by their surroundings.

Lack of that organization which has secured favourable positions at former exhibitions may have been the primary cause of the failure at Paris, but in allotting such a position for the exhibition of the English carriages, products of an arts manufacture, the French authorities did not show common courtesy. Parisian coachbuilders, however, were scrupulously careful, not only about the position of the French exhibit, but about its quality. Their syndicate allotted the best positions to the firms who in their opinion were the best builders, and they also fixed the number of carriages that each should exhibit.

A modern feature of international exhibitions, whether held in this country or abroad, are the visits of artizans sent to report for the benefit of their fellow craftsmen on the novelties they may find. These men are, by reason of their training, well calculated to be able to decide with judgment on the merits of the articles exhibited, and to report on the progress made in various branches of manufacture.

1889 saw a remarkable development of this grand idea. Numerous companies of artizan reporters visited Paris, not only from Great Britain, Belgium, Italy, and other European countries but from the United States of America. To Alderman Sir James Whitehead, Lord Mayor of London, the manufacturers of this country owe a debt of gratitude for the generosity which enabled 76 English working men to visit Paris and to describe the condition of their various trades as evidenced at the exhibition. The Lord Mayor's committee selected Mr. J. W. Robertson and Mr. C. Kinggate as their reporters on carriage manufacture. The discernment and dexterity with which Mr. Robertson accomplished his task are evidences of the value of a thorough technological training.

A wise policy has been adopted in the editing of the reports gathered by the Mansion House committee. The individuality of each report has been strictly preserved, although the views expressed were not necessarily in accord with those entertained by the committee. As was to be expected the Mansion House reporters varied considerably in their opinions as to the condition of the different trades they represented. In some cases their reports and those of men from the provinces have given umbrage in certain quarters, and more than one reporter has been abused in the trade journals for daring to praise the work of our rivals when he honestly thought that such praise was merited.

The very fact of a man being chosen for the duty was a sufficient evidence that he was qualified for the work and might be trusted to speak the truth.

Many of the great industrial centres sent their own representatives and in some cases the workmen went to see for themselves and at their own expense. Some private firms in London sent a man from each department of their manufactory on the condition

that they prepared a written report. In Newcastle and other large towns, some months previous to the opening of the exhibition, hundreds of artizans formed themselves into clubs, paying instalments weekly until they had realized sufficient to pay their expenses to Paris for a fortnight.

Mr. Foggett's report is the first outcome of the Hooper Testimonial Scholarship Fund, Mr. Hooper having generously decided to utilize last year's interest by sending a reporter to Paris.

I have included amongst the reports one by Mr. William Gardiner, a delegate from the Irish trades. He was one of several who visited the exhibition at the public expense. For that purpose between £200 and £300 were subscribed in Dublin, and thirteen delegates were sent. Like many others, these delegates complained about the great difficulties experienced in obtaining information, the arrangements having been mismanaged.

They were not permitted to make either notes or sketches and they found themselves obliged to wander more or less aimlessly about that vast congregation of the world's products displayed by 60,000 exhibitors.

In 1878 the Worshipful Company of Coachmakers, through their Master, Mr. Charles Saunderson, sent six reporters to Paris. They were requested to direct their attention to such matters as would be useful to British workmen in general and the result was a series of interesting reports which have rarely been equalled and which are prized by those who possess copies.

It is a gratifying fact that the Worshipful Company, during the Mastership of Col. Bristow, have taken a step far in advance of any other body in their enlightened efforts to advance the art. They have chosen six *(a)* of the most successful prize winners in their competitions and experienced technical teachers for the purpose of conferring upon them the distinction of the honorary freedom of the Company. Such generous encouragement must result in the development of talent in the ranks of the younger generation of coachmakers, and will induce the sons of masters and many others to compete for such an honourable distinction.

In 1878 it was possible to draw a comparison between English and French carriage-building, because the coachbuilding trade of this country was then fairly represented. A larger number of British carriage manufacturers exhibited, and no less than thirty-six received awards. The distinction of Chevalier of the Legion of Honour was conferred upon Mr. J. W. Peters.

At the exhibition of 1889 the number of English carriage builders who sent specimens of their work could be counted on the fingers of one hand.

It may be that the experiences of 1855 have not yet been forgotten by London and provincial builders. On Wednesday,

(a) L. T. Butler, London; W. T. Casson, Great Malvern; Thomas Coward, London; John S. Foggett, Newcastle; Wm. Philipson, Newcastle; J. W. Robertson, London.

December 5th, 1855, Mr. Geo. N. Hooper read a paper before the Society of Arts on the carriage department of the Paris Exhibition of that year. During the discussion on that paper Mr. Peters gave the reasons for the coachmakers of London not being more numerously represented. He said:—"The real grounds were—first, because the room allotted to them was so exceedingly limited, each exhibitor only being allowed space for one carriage; and, secondly, the high rate of duty chargeable upon all English carriages sold there. It was the impression of many that coachbuilders were entirely arbitrary in their mode of fixing the charges for carriage-building, *such charges bearing no reference to the cost of production and generally being far too remunerative;* but this, he begged to say, was an error, as their charges were based upon a careful calculation of the cost, and *a reasonable profit only made.* If they had sent to the Exhibition, therefore, in order to meet the high duty with any profit to themselves, they must either have made what would have been considered an exorbitant charge for carriages exhibited, or have used inferior materials, and they considered, therefore, with due regard to their own reputation, that it was advisable no steps should be taken to induce English coachbuilders to be more fully represented than they had been."

The paucity of exhibits by British coachbuilders in the Exhibition of 1889 is to be regretted. It caused the visitor to carry away a very misleading impression of our capabilities; an impression that will have its effect on our chances of success in the markets of the world.

This apathy is all the more to be deplored when we remember that the export trade of British carriage manufacturers has long been decreasing. Their attention was directed to this subject in the appendix to the Artizans' Reports of the Exhibition of 1878.

Sir Charles Adderley furnished the editor with a table of quantities and value of road carriages imported and exported during a period of fourteen years. *(b)*. It showed an alarming decrease in our exports and a very large increase in our imports. It is a well-known fact that the export trade of the French is represented by very substantial figures and that with more than one South American country they are at present carrying on a very lucrative business.

In Australia and South Africa we have almost been beaten out of the market by the coachbuilders of the United States of America, while in South America we are fighting a losing battle with them and the French. The American carriage builders find a ready sale for their work by reason of the excessive cheapness of their productions, while our French competitors succeed in obtaining profitable prices in these countries by selling a well-constructed carriage made and fitted to meet the peculiar tastes and requirements of their customers. English coachmakers can hardly be expected to compete in that class of work for which the Americans are celebrated, but, provided we adopt the same methods as the French, there is no apparent reason why we should not be able to compete with them and to obtain a share of the orders which are now monopolised by our neighbours.

The methods by which some American carriage builders—not the recognised heads of the trade—produce so cheaply are readily understood. The application of machinery wherever it can be used, uniformity of sizes, interchangeable parts *(c)* together with the employment of a cheap class of materials in the construction of vehicles all similar in shape and size are the means by which the cost of manufacture is reduced. But under such conditions, coachbuilding ceases to be an art. It is a mere matter of reproduction. The idea is repulsive to anyone with artistic instincts. Better far to follow the example of Leclaire, who, at the suggestion of M Frégier, was the first to bring about the participation of the workmen in the profits of the master and to show the value of associated instead of divided interest. We could thus improve the quality of our work while we cheapened its production.

Bearing in mind the small number of British carriage manufacturers who exhibited at Paris, we cannot but regard with satisfaction the fact that the French authorities chose two Englishmen to act in the capacity of jurors in the coachbuilding section. The selection of jurors who are to be entrusted with the distribution of rewards is at all times a delicate task, but the choice in this case was a guarantee of the impartiality with which the awards would be assigned; it was an assurance that prizes would not be given for merely individual competition but for excellence in whatever form it might present itself in the vehicles exhibited.

No one of the members of the jury in class 60 had better qualifications than those possessed by Mr. Charles Holmes, whose early training and subsequent labours have eminently fitted him for such onerous duties.

Our laws give us the privilege of trial by jury and the jury is, or should be, chosen from members of the class in which we have lived and moved. Consequently, the man who is entrusted with the duty of judging on the merits of a carriage, or of any other manufactured article, ought to be one who is acquainted with the processes involved; in short he should be a carriage builder. Unfortunately this is not always the case. The onerous duty is too frequently entrusted to an amateur with a fad, a man who is neither capable of cool thinking nor above being carried away by prejudice.

(b) The president of the Institute, Mr. G. N. Hooper, and the secretary, Mr. A. W. Barr, are now engaged in collecting similar information. The results of their labours will be of considerable interest and advantage to the members.

(c) The coachbuilders who made and maintained the mail coaches running between York and Edinburgh and in other parts of the country 50 years ago were the first to use interchangeable parts. Their axles, springs, and wheels were all interchangeable.

It requires no learning to fulfil the character of a juror in a Court of Jurisprudence, but the converse holds good in an exhibition of manufactures, and until this fact is recognised there will always remain manufacturers who will abstain from exhibiting through the fear of being oppressed by men unworthy of possessing the valuable prerogatives with which they have been invested. The revision of jurors' awards is another important factor in the matter. If jurors in the first place are experts a revision of their judgment is intolerable; it is unjust (*d*).

The reporter who was sent to Paris by the President of the Institute has made some remarks on the tendency of English carriage users to sacrifice everything to utility. Applied to the provinces his remarks are unfortunately too true, but it should not be forgotten that in London the vehicle "de luxe" is not unknown. It is the favourite carriage of fashionable society, although its inward ornamentation may not be so lavish or so costly as that of the Parisian prototype. To quote the words of a well-known author in a recent article:

"The brougham of the present day, fitted up inwardly and outwardly with all manner of comfort-yielding appliances—the noiseless and equable, elegant and unobtrusive brougham—may claim to be one of the most satisfactory products of skilled workmanship that British industry is entitled to boast of. . . The cunningly contrived cavities with which the inner casing of every well-built brougham is liberally provided are every whit as receptive of the fan and scent bottle as of the cigarette case and matchbox. . . It carries a clock securely fixed to an ornamental shelf, an elegant reading lamp warranted to do no wrong to silken skirts or velvet mantles, a gorgeous card case nestling luxuriously in its own special niche, a cosy foot-warmer encased in costly fur, a speaking tube through which the fair occupant can impart her will to coachman or footman without the least delay or physical exertion. In such a construction as that for the 'turning out' of which English brougham builders have earned universal renown, every comfort is supplied, every reasonable requirement forestalled. It is typical, and favourably so, of the practicability, as well as of the good taste and refinement, by which latter day civilisation is conspicuously characterised."

In London, however, there are very few carriages which have interior accessories costing £40, a sum that is very frequently expended by Parisians.

(*d*) "The awards and their classification for this department are very eccentric. It is difficult to guess what principle has guided their selection. A feeling, however, exists among many British exhibitors that the original awards of the jurors have been considerably altered by the Committee of Revision appointed since the dispersion of the juries."—G. N. HOOPER on the Construction of Carriages, *Journal of the Society of Arts*, Dec. 7th, 1855.

The reporter characterises the modern tendency as a sacrifice of beauty to utility. He might have added, a sacrifice of both to *cheapness*.

In recent years we have seen this tendency encouraged by coachmakers themselves. Acting as jurors they have been known to award gold medals for vehicles made to run either as two or four wheelers. Every attention has been paid to the transformations of these carriages, while design, workmanship, and general appearance are utterly neglected. Yet such productions have been placed ahead of carriages symmetrical in form, suspended with scientific accuracy, and finished from the foundation with the utmost good taste and finish.

Beauty and utility are not antagonistic, but, generally speaking, beauty and cheapness are incongruous, and such things as accurately-finished axles and springs, with carefully case-hardened arms and tempered plates, are incompatible with cheapness.

Professor George Wilson has said—"The fiction seems eradicable from some minds that a beautiful thing cannot be a useful thing, and the more you increase the beauty of the necessary furniture or the implements of every-day life the more you lessen their utility. Good folk of this sort seem to labour under the impression that the secret desire of art is to rob them of all comfort. Its unconfessed but actual aim, they believe, is to realize the faith of their childhood when it was understood that a monarch always wore his crown, held an orb in one hand and a sceptre in the other, and a literal interpretation was put upon Shakespeare's words, 'Uneasy lies the head that wears a crown.'"

There was a time when the coachbuilder prided himself upon his originality. He made no two carriages alike, and each builder had his own style, but "the old order changeth." Some carriage manufacturers of the present day makes as many carriages of the same pattern as possible, because they can thus produce them quicker and cheaper.

The work of editing the reports contained in this book was undertaken by me at the request of the Council of the Institute. The duty could have been more ably fulfilled by other members and the compliment could have been more fittingly paid to them. A testimonial having been raised to mark approval of my exertions for the modification of the Carriage Tax—a mark of approval for which I am very grateful—it occurred to me that such a fund could have no more suitable application than that of being applied to defray the cost of publishing this volume.

But the agitation which has been carried to such a successful termination, would not have had such a happy result had it not been for the hearty co-operation and unselfish exertions of our enlightened President, and of Mr. H. M. Holmes. With the assistance of our Scotch friends under the presidency of Mr. John Robertson, of Glasgow, we have succeeded in obtaining a desirable degree of relief from the weight restriction and similar anomalies which tended to degrade our art by encouraging the production of light and flimsy vehicles devoid of either strength or just proportions.

Emphasis has been laid upon the superiority of the technical education of the French workman compared with that of the English artisan, but in belauding the Gaul we are apt to forget his Teutonic neighbour, who is equally advanced and whose polytechnics might serve as models for any nation. A short time ago Mr. Thrupp, one of the pioneers of technical education in England, called Paris the first home and birthplace of scientific and technical education as applied to the construction of carriages, because at Paris 120 years ago was published a book giving what was then supposed to be a complete account of how to make all sorts of vehicles then known. On a recent occasion our President, Mr. Hooper, drew attention to the fact that one rule laid down by the trades union of the carriage workmen of Paris is that a technical school shall be established and maintained for the advantage of the Paris workmen, and that the sons and young relations of the members shall be carefully taught their trade in the workshop and the *technical class* in order to render them skilful workmen and good citizens.

There are some who believe that we, as a manufacturing nation, are very far in advance of the French, and that our technical education in many departments, such as engineering, would not suffer in a comparison with theirs, and there are other well qualified judges who consider that in some branches we are behind in design, but far in advance in construction *(e)*.

There are many excellent technical classes for coachbuilders both in London and the provinces, and we are gradually approaching that stage of co-operation between employer and workman which is necessary to ensure the success of the system. But for the purposes of technical education, the French coachbuilder receives greater encouragement from the State than the English manufacturer. Granted equal facilities the English artisan would have greater scope for the employment of his talents and more substantial rewards for superior and artistic work. However, there is reason to believe that the prevailing movement for the dissemination of art knowledge and scientific training will result in the success of the coachbuilder, who can endow his productions with those qualities which impart beauty to his work.

J. P.

Newcastle-upon-Tyne, July 17th, 1890.

(e) "France at present is in front in design, but behind in construction; we are far in advance in construction, but not in design. But I contend that we are the best off, for art is only a secondary consideration, seeing that it must give us hope to combine our construction with design, and if that is done I feel that we shall not only be equal to other foreign nations, but I see no reason why we should not be in advance."—*Mansion House Report on Carpentry and Joinery.*

A REVIEW
OF THE
CARRIAGES
AT THE
PARIS EXHIBITION,
1889.

TO G. N. HOOPER, ESQ., F.S.A.,
President of the Institute of British Carriage Manufacturers.

SIR,—As the first recipient of the scholarship which has been founded in recognition of your labours for the elevation of the art of carriage manufacture, I visited Paris between the 9th and the 18th of July for the purpose of preparing a review of the vehicles gathered together under the vast roof of the Exposition Universelle Internationale of 1889.

The result of my observations I now have the honour to lay before you.

The French did not originate exhibitions, but since 1798, when the Marquis d'Avezè returned from proscription to Paris, and succeeded in carrying to a successful issue his labours for the exhibition of some objects of industry of the national manufactures—labours which had been rudely interrupted by the decree of the Directory for the expulsion of the nobility—the French have, by their exhibitions and their patriotism, done much for the cause of peace and civilization.

Unless a delegate to the late exhibition carried with him credentials from an important municipal or other corporation to the French authorities he was beset by a number of petty difficulties which made his task somewhat difficult of accomplishment.

At the instigation of the French workmen, the authorities carried to an absurd length their restrictions on writing and sketching within the precincts of the exhibition. The unfortunate reporter, whose hand happened to hold a piece of paper and a pencil, received from the gendarmes little personal attentions which, when renewed again and again, made liberal demands on his patience and good temper.

The French police, in some cases, thought it politic to profess ignorance of the certificate with which your reporter was kindly furnished on his arrival by the British commissioner, Mr. Trueman Wood, and it became necessary to supplement it with the authority of the Director General, M. Berger, which was obtained through the kind assistance of Mr. C. A. Heergeist, editor of the *Carriage Monthly*, Philadelphia, and commissioner from the Carriage Builders' National Association of the United States. An authorization to sketch could be obtained from the Director General, but, was worthless if the exhibitor or his representative objected, and this they seldom failed to do.

Mr. Heirgeist spent a fortnight in obtaining the necessary permissions to carry out the work that he had crossed the Atlantic to perform.

In class 60, group 6, the French showed 140 carriages; 109 being the productions of Parisian builders, while the remaining 31 were contributed by provincial firms. Each exhibitor was granted space for five carriages, but many good firms only showed three.

The exhibits of the French and of their neighbours, the Belgians, who showed 10 carriages, were splendidly situated; they were grouped with method and order, and the utmost care and expense had been lavished on the back-grounds and other accessories which go to make up an exhibit that will interest and inform the visitor.

The decorations of the building in which the carriages were displayed have been fully described by the trade press, and need not be dwelt upon here, but it could only be accomplished by the combined action of the exhibitors, an essential that had evidently been lacking on the part of the five English firms who showed 21 carriages.

They stood in a position vastly inferior to that accorded to the French and Belgian exhibitors, being located at one extremity of the large machinery hall, amid dust, and noise, and heat. The effects of such a position, which was shared in a measure by the Swiss, may be readily conceived. Cloth, lace, and other fabrics exposed to such an atmosphere (the thermometer on one particular day registered 110 degrees Fahr.) were fading, varnish was blistering and losing its lustre, and it had been necessary to re-varnish portions of several carriages in this section. Amongst the carriages exhibited by English coachbuilders, there was nothing better than might be found at any time in their show-rooms. The finish of their vehicles was neither better nor worse. On the other hand, the French carriages are faultlessly finished when intended for exhibition, but a casual glance at the vehicles in the Parisian show-rooms makes it evident that their builders bestow very much greater care on work that must bear the critical inspection of their

rivals and the public, than they do on the carriages usually manufactured for sale.

The collection of drawings and paintings representing methods of transport during a period extending from the time of the Assyrians to the 19th century, was probably the most complete ever got together. Your reporter was pleased to observe that so many examples had been contributed by Englishmen and by English institutions. The specimens submitted by the Institute of British Carriage Manufacturers, the Worshipful Company of Coachmakers, Messrs. Hooper & Co., Mr. A. W. Barr, and Messrs. Atkinson and Philipson, formed a very large part of an exhibit which no coachmaker could view without interest and instruction.

BODY-MAKING.

In examining the French carriages, a thoughtful person could not fail to be struck with the fact that it is in body-making that the art of design becomes of value and importance to the coachbuilder. It is an art long cultivated by French carriage manufacturers, but of late years neglected by those in this country. Forty years ago the positions were reversed, and every English coachbuilder who visited the Exhibition must have observed that the bodies of the French carriages bore a very close resemblance to the English vehicles of that period.

They abounded in beautiful lines, and their proportions were excellent. The lines of some of the French bodies afforded a lucid illustration of the rule so well known to every student of design, that "*Curves are beautiful just as they are subtle in character*," and that "*Those which are most subtle in character are the most beautiful.*"

The French draughtsmen also realise that *proportion*, like the curve, must be of a subtle nature, and rather than mar the outline and proportions of a carriage body, some builders, like the recognized heads of the trade in London, continue to employ the wood pump-handle, notwithstanding its liability to rot.

As an outcome of the prevailing demand for lightness, we are within measurable distance of the ugliness that characterizes many of the American carriages. It is a sacrifice of beauty to utility. We know that the two are not inseparable, but surely they are not so incompatible one with the other as some modern carriages would lead us to suppose.

Out of the 140 carriages in the French section, there were not 20 of a national type. The large majority were distinctly English, and in copying English styles, the builders also adopt particular designs that have long been associated with the names of the first firms in London.

To an Englishman, many French carriages appear unduly heavy, but their very weight conveys an impression of stateliness that must be admired.

Being questioned on this subject, an eminent Parisian coach-builder replied—"I know our carriages are too heavy, but it is the present fashion. Fashions change more rapidly in this country than in England, but, I expect that in two or three years we shall shall be producing carriages quite as light as yours."

In reviving old English styles, all the French builders appear to have adopted the open quarters of the George IV. and Elcho phaetons. Those quarters were to be seen in carriages of every description, including landaus, but more particularly in mylords. They serve to lighten somewhat the otherwise ponderous look of some bodies of cabriolet pattern, but the bottom sides are unsightly to anyone accustomed to the present English styles. The French builders are not successful in their efforts at lightening the bottom sides. When this style prevailed here, the bottom sides were lightened out to the fullest possible extent by beading, and the wood was dressed to a point at each bolt head. This treatment did much to relieve the necessarily heavy appearance.

The panels of many open-quarter carriages in the Exhibition were covered with sham-cane. When they were fashionable in this country, the canework was real, a carver and a caner being kept at many manufactories. Real canework was superseded by a method in which the painter ran on the lines from a curved tube of colour; the pattern having been already marked, and each line of colour being allowed to dry before it was crossed by another. This mode is now practised in some of the best factories in Paris, but the majority of the builders buy their sham-cane by the yard, glue it on the panels, and varnish over it. Owing to the comparative straightness of the sides of French carriages as made at present, this plan does not present any difficulty, but when there is much round on a body there is trouble in making the preparation conform to the sweep of the panels.

One cabriolet had open quarters and double panels, or rather, the panel was divided at a distance of 3in. from the bottom by a ⅞in. moulding, the upper part being filled in with imitation canework. The bodies had but little turn-under, and the mouldings were very narrow, and usually round. One carriage had a round moulding on the bottom arch panel. The bottom and upper edges of the boot-sides of several carriages were rounded, with the result that the heads of the pins showed through the paint.

There were several ingenious methods of concealing the front "occasional" seats of victorias exhibited in the French section,

but that of the Messrs. Belavalette was the best. The method has been patented in France, and will probably be protected in this country. Fig. 1 will serve to illustrate the method which works almost automatically when the driving seat is raised, and with remarkable smoothness.

The driving-seat is hinged to the front of the boot-sides, and lifts towards the dasher. Across the underside of the driving-seat there is an iron roller-bar carrying a hanging-lever on each end. The seat swings from the extremities of the levers and folds up and under the driving-seat whenever the latter is raised. For preventing damage to the paint there are two brass studs let into the panel on each side, and the seat hangs against them.

A bodymaker to the trade exhibited another method of disposing of the child's seat (fig. 2). The iron bars across the boot-sides, and the two slots cut in the panel under the driving-seat to admit the hanging-bars of the seat, are very unsightly, but, of course, the former are covered by the valance of the driving-seat. This valance is made fully an inch or an inch and a half deeper in Paris than in London. The same exhibitor deserves the credit of having shown the best specimens of unfinished work in the Exhibition. His landau, mylord, and char-à-banc were shown in the varnished wood, all the ironwork having received a coat of silver lacquer or paint to protect it from the atmosphere; this imparted a very attractive appearance. The nave-hoops, head-joints, and lamp-sockets were coated with gold paint or lacquer. French coachmakers give very great attention to the blocking of the panels of their carriages. Brick blocking is general, the panels being entirely covered with closely-fitting squares. In this exhibit it resembled a chessboard, being done with alternate pieces of light and dark coloured woods.

During the summer of this year a considerable number of broughams were made in Paris for South America. If built in this country such carriages would have the roofs and quarters covered with russet hide, but the French do not cover the quarters of carriages they make for hot climates. They are scrupulously careful in the selection of their panel wood, in the close blocking of the inside, and in the purity of the glue they use, and they appear to be very confident that their work will withstand the effects of a very trying climate. For some parts of India, such as Burmah, where the climate is exceptionally moist, such work would be useless.

The doors of French broughams generally have two dove-tail catches, one above, and the other below, the lock. Those dove-tails are much longer than is usually the case in English work. One brougham is fitted with a plate at the bottom of the pillars, and this is evidently intended to serve the same purpose.

The heads of victoria phaetons had three slats instead of four, and one or two had spring-balance fittings worked from the inside. In one mylord the head slats were not hinged to the pillars, but to the hand-rails at the sides of the seats. This left a clear space between the bottom of the slats and the elbow, but that was covered by the head-leather. The wings of some hooded carriages, such as mylords, had a socket which fitted on to the hind prop below the head-joints, consequently there were no screw holes in the body to putty up.

A landau was shown with a driving-seat within two or three inches of the line of the head-leather, and a very ingenious arrangement was adopted for allowing the head to fall. The seat was hinged on to the top of the boot-irons, and folded forward towards the dasher. When the seat was raised the boot-sides folded inward out of the way of the head, and being held in place by spring catches, the carriage appeared to have a skeleton driving-seat when the head was down.

Many prominent makers have abandoned the use of metallic flaps for carrying the glass frames of landau doors. One firm showed an arrangement in which the rattling of the flaps was prevented by the action of spiral spring-catches holding the flange of the flap when down on the fence rail; but the leading builders say that the flaps are neither air nor water tight, and they hinge their pillars at the elbow line, so that the tops may fall inside the door when the head is lowered. They do not take up much room, although this is an objection very often urged against the plan.

One of the oldest and most respected firms in Paris exhibited a brougham, half of which was completely finished, while the remainder was left in the wood and iron, the exterior wood being varnished in the natural colour. It was an excellent piece of work all through. In this, and in the exhibit of the Cab Company of Paris, it could be seen that the body-plates have branches to the front and hind pillars and to the hind cross-bar. Those particular edge-plates had a few bolts in them, but screwing is the general practice in Parisian workshops.

Mild steel is used for body-plates, and it is asserted that those employed by the Cab Company only weigh 390k., whereas the former plates of iron used to weigh 600k. Such a statement will hardly bear examination. The iron body-plates were either too heavy, or those now used are too light.

The mortice and tenon joint is still largely used by French body-makers. It is difficult to find a screw in any part of their work. They employ glue and pins almost exclusively. The upper panels are always glued on and cramped until dry, so that there

are no pin-holes. The English method of half-lapping the framing, using white lead at the joints and screwing, is not only easier but stronger than the French plan, which used to be general in this country also. At that time the standing and corner pillars, case-rail and elbows—in fact, almost every joint in the body, was morticed, tenoned, and pinned.

The Paris Cab Company exhibited a section of a brougham with the roof and quarters entirely covered with a sheet of galvanized iron 1/2000m in thickness. The Cab Company have now used iron panels, both in broughams and victorias, for a number of years, and apparently with complete success. One would expect that such carriages would have a drumming sound when running, and no more than ordinary preventions appear to be taken to prevent vibration. The roof is covered both with canvas and leather, and the panels are pinned to the framing from the outside. The pins must, of course, show through the paint, but in the case of the doors this is not so objectionable, because the bead on the doors covers the heads of the pins; but in the quarters they are plainly visible, and cannot be properly painted over. The difficulty in canvasing the panels to the framing is got over by coating the iron with a specially prepared paint, to which the glue will adhere. The Cab Company also fit to the bottom of their brougham doors a zinc grating, which not only prevents an accumulation of water, but permits of a certain amount of ventilation. They showed an admirable application of the slide-rod, instead of leather door-stops, on their brougham.

Speaking generally, the landau bodies, like the majority of other French carriages, were all of full size. No attempt seems to be made to reduce either weight or dimensions, nor to dispense with the ungainly outside head-joints The curved form is invariably used, and the stump-joints are of a variety of makes.

The firm that exhibited the half-finished brougham showed an improved double-joint on their landau, in which it is impossible to injure the fingers when striking the head. The majority of the head-plates extended a considerable distance over the top, and had a clumsy appearance.

The heads of landaus do not fall nearly so flat as in the English carriages, but the French system of hingeing the inside seats so that they may be raised when the carriage is open, in a measure overcomes the objection.

One of the landaus shown in the British section was fitted with what are termed flush head-plates. The upper plate has a lip or flange that falls into a channel or groove underneath, thus forming a watertight joint.

A novelty in the shape of a large double coach, or covered char-à-banc, was shown by a French builder. The form of this vehicle was that of two coach-bodies open at the sides, and having a large front boot. There were six seats on the roof, including the driving-seat. It was intended for South America, and was capable of carrying from 40 to 50 passengers, with a considerable quantity of luggage. It was constructed to be drawn by four or five horses or bullocks, and had ample room for four, or scant for five, persons on each seat. The ironwork of this vehicle excited the admiration of everyone who examined it. The square portions were as truly ground and viced as though turned off by a planing machine. It may be mentioned, however, that when this carriage was fully loaded and tested by the jurors, the front springs were found to be quite rigid and unyielding. Passenger carriages in the country for which it is intended have to bear very rough usage, but the builders in this instance far exceeded the dimensions necessary for safety and durability.

It has been said, and principally by the French themselves, that there was nothing new in the carriages at the recent Exhibition. Applied to the bodies of their vehicles, this remark was almost literally correct. There was much that was very old. There were not lacking some evidences of individual ingenuity, but in one or two notable instances such efforts were misdirected. One coachbuilder surpassed himself in the production of a carriage capable of no less than 15 different transformations. It was anything and everything, from a pony-car to a wagonette-omnibus. Surely, human ingenuity can go no further !

A number of American and French bent-timber manufacturers showed specimens of their skill. They arranged their exhibits in a most artistic fashion, but the accuracy and truth of their work fell short of that produced by Mr. T. W. Hopton, of London, who, like other British exhibitors, was most unfortunate in the matter of position.

This gentleman exhibited a novelty in the shape of a cart-side and shaft in one piece (see fig. 3).

It was 11ft. long from the back of rail to the point of shaft, and 21ft. long before being bent.

English ash of sufficient length being difficult to obtain, rock elm was employed for the purpose.

It has been introduced to avoid the trouble of framing, and so that the whole side of a Whitechapel cart-body may be rigid, and without joints.

It is hardly probable that this method will find wide employment, because it would present difficulties that could not be tolerated in

a dog-cart of the finer class. Every movement of the shaft would mean a movement of the body, and the balance could not be regulated except by means of the seat.

For spring carts of the heavier class where easy motion is of less importance than strength and carrying capacity, it fulfils the purpose for which it has been devised, and it marks a distinct step in the art of the timber bender, to whom the coachbuilder owes much of the lightness and strength of his productions.

The hansom cab shafts of the same exhibitor, compared very favourably with those of his foreign rivals in other parts of the building, where we might find some with room enough for two horses at the points, and others that seemed to be intended for a goat ; this, of course, means a good deal of extra work for the "woodmen."

Parisian body-makers, or, at any rate, those bodymakers who are employed by members of the Syndical Chamber of Coachmakers, are paid at an uniform rate for their piece-work.

They have, what in some English trades is called a "log" or tariff ; a plan that is very effective in preventing friction between employer and employed.

There is a stipulated price for the simple "body," and regular tables of rates for pieces of work which, in France, are evidently regarded as extras ; but which in this country are invariably considered constitutent parts of the whole.

In England, a mail-coach body without either front or hind boot would be something of a novelty, yet the boots are paid for as extras in Paris.

The tariff commences with the price for the framing of the body, no matter what the carriage may be, all grooving, pannelling, beading, fitting of folding head slats, seat boards, &c., are calculated as extras. If there are three hoop sticks in a folding head, the third is paid for quite distinctly from the other two, and if there are four, the fourth or principal slat is paid for separately.

Therefore, it can easily be understood that the price for a finished body is represented by very different figures to that paid for the body simple.

The following list will show this difference and will serve to afford a comparison with the prices paid to English workmen.

	Fcs.
A DOGCART of ordinary English pattern	66
Total price with gun case between seats and venetian sides	119

	Fcs.cts.
STANHOPE GIG body	61
Total price with 4 slats for folding head, mouldings on seat, circles, and brackets,	119
VIS-A-VIS body	77
Total price with framed and pannelled boot, and driving seat and folding head	157
A STANHOPE PHAETON body	87
Total price with folding head, slats, mouldings on seats, etc.	100
LADY'S DRIVING PHAETON	100
Total price with railed sides	116·35
A MYLORD without door	65
Total price with body mouldings, head, slats, etc.	117·50
,, square pattern	60
Total price	126·50
,, railed sides. Total price	141·35
SOCIABLE—caleche body	92
Total price with frame and pannelled boot, doors and folding head	187·50
SINGLE BROUGHAM	135
Total price for finished body	217·50
THREE QUARTER BROUGHAM—square front	135
Total price	261
SINGLE LANDAULETTE	145
Total price with framed and pannelled boot,	226·50
THREE QUARTER LANDAULETTE	145
Total price for finished body	259
CANOE LANDAU	145
Total price	263·50
ANGULAR LANDAU	135
Total price	271
FOUR WHEELED HANSOM	150
Total price	237·50
A TWO WHEELED HANSOM	150
Total price for finished body with ogee quarters	259
LARGE WAGONETTE or BREAK for 8 passengers	120
Total price with pannelled sides	157
PRIVATE OMNIBUS, 3 windows in each side	210
Total price	273

	Fcs.cts.
PRIVATE OMNIBUS, 2 windows in each side	185
Total price with mail-coach boot	281
or with angular corners and latticed boot-sides	312·50
MAIL COACH—Berlin body	160
with two boots	260
Total price for finished body	386

As explained in another place, the Parisian bodymaker neither fixes the edge-plates nor hangs the doors of any carriage.

PRICES OF SOME OF THE CARRIAGES IN THE EXHIBITION.

		Fcs.
Pair-horse Landau	French	5,000
Cee Spring D'Orsay	,,	5,500
Cee Spring Cabriolet	,,	5,000
Brougham	,,	3,800
Cabriolet	,,	3,600
Carved Sleigh	,,	4,500
Brougham	,, sold	4,000
Cee-spring Cabriolet	,,	5,500
D'Orsay "Cee-springs"	,,	6,000
Caleche ,,	,,	6,500

The above carriages were the productions of two of the first houses in Paris.

Cee-spring Victoria	Spanish sold	5,900
,, Brougham	,, sold	6,400
Gig	,,	2,000
	but would accept	1,700
Calesa	cost 8,000fr. to make	
Sledge	Roumania	1,000
Buggy ("weight with shafts 148½lbs.")	American	465 dollars.
Brougham	,,	1,300 ,,

SOME PRICES QUOTED IN THE SHOWROOMS OF THREE LEADING FIRMS.

	Fcs.	
Landau ("angular") Cee-springs	6,800	satin trimming.
Landau ("canoe") 5 glasses	4,500	
Landau ,, pair horse	5,000	
Landaulette ("single")	3,900	
Landaulette ("double")	4,200	
Mail coach	10,000	
Double Victoria	3,600	
,, ,, on cee-springs	5,500	

	Fcs.	
Victoria with skeleton driving seat and rumble	3,300	
,, with head	3,000	
,, ,, ,, cee-springs	4,800	
Four-wheeled hansom	3,600	
Hansom cab	3,600	
Single Brougham elliptic-spring	3,800	satin trimming
Double ,, ,,	3,900	plain trimming
,, ,, cee-springs	5,400	satin trimming 250fr. extra.
Single ,, ,,	5,200	satin trimming 200fr. extra.
Mail phaeton ("light") 8 springs	4,400	
Stanhope phaeton elliptic-springs	2,800	
Tilbury gig with head	2,000	
Sleigh plain	1,200	
,, carved	3,000	
Battlesden car	1,300	
Four-wheeled rustic phaeton	1,600	
Whitechapel cart	1,500	
American phaeton	2,500	
Ladies' driving phaeton with rumble	2,500	very plainly trimmed.
English dog-cart	1,500	
A private omnibus with roof seats	5,000	

UNDERCARRIAGES.

An exhibit to which English coachbuilders appeared to devote a considerable degree of attention, was that of M. Jeantaud, who has evidently made a study of applied mechanics. He showed a mail coach with pivoted axles in front, but these are neither new nor original. They were invented by an English coachbuilder many years ago, and were used for some time in America, but have long since been discarded. The very rough sketches, figs. 4 and 5, are made from memory, but will serve to show the action of the pivoted axles. There is, so to speak, no front axle, and it would naturally be inferred that having got rid of the locking difficulty, the builder would have made an attempt to reduce the coupling or distance between the front and the hind wheels, but he does not appear to have concerned himself about this.

It will be seen that the wheels are turned by the action of the pole, which is fitted into a long socket connected with levers at the back. Those levers are clasped round the axle box and when the pole is moved to one side, no matter how slightly, it acts on the levers, and they in turn act on the wheels which turn where they stand.

The carriage may be turned within a radius of 3m. 75 (equivalent 12ft. 3in.), so that in one complete revolution, the track of the four wheels is contained within a circle of 7m. 50 (24ft. 6in.) in diameter, while with ordinary axles the diameter of the circle is 15 metres or 49 feet.

It is claimed that the wheels have no side-motion, that the carriage does not zig-zag in running, no matter how bad may be the condition of the road; that it is impossible to overturn the carriage or break the pole, and that there is remarkable ease and freedom from concussion.

The length of the axle arm and box is undoubtedly a strong point. It conduces to steadiness. But the wheels are turned aside by the slightest movement of the pole, and when horses are attached this incessant motion of the wheels out of the straight line must cause *a great increase in draught*, and although the joints of the fore-carriage are exceptionally strong, they must eventually work loose. The price of the coach was £320, or if fitted with refrigerators, clock, luncheon basket, horn and other accessories, £400.

The same exhibitor showed a mail phaeton with a jointed perch, or rather a perch with a socket four inches behind the perch bolt. This prevents the perch being twisted by sudden and severe strains, and the carriage is so hung that when the wheels on one side encounter an obstacle, and are suddenly thrown upward, one part of the perch revolves in the socket, and owing to the method of suspension, the level of the body is but very slightly disturbed. The carriage to which this invention had been applied was standing with the wheels of one side raised on blocks several inches above the ground, while the body was nearly level.

This is an excellent idea, but it has yet to be proved that the perch will not rattle when the carriage has been in use a short time.

Warner wheels or, at any rate, Warner hubs predominated in the English and American sections. Where the hub was not used, bent rims of hickory were adopted. The felloe-plate with which it was customary to join and secure the ends of the rims has been in many cases supplanted by a spike-clasp, which is knocked into the end of either felloe. It has not such an objectionable appearance as the old plate, but it is not so safe. It frequently drops out when the carriage is in use.

The wheel with a periphery composed of several felloes would appear to be gradually dropping out of use, being supplanted by the bent rim in two pieces.

Nothing could show so plainly the weakness of a rim with ordinary felloes as a section exhibited by a French wheelmaker.

In this, it was clear to the veriest tyro that when a piece of wood about 18 inches long is bored with holes to receive two spokes and two rivets, and is split longitudinally with two holes to receive dowels, there is not much substance remaining to withstand the rough usage to which a wheel rim more than any other part of a carriage is subjected.

The exhibit was intended as a specimen of good workmanship, but the timber in some parts was not good and the fitting of the dowels was defective, affording a sorry contrast to the accurate joints of an American machine-made wheel.

A French timber bender showed a wheel with every two spokes formed out of one piece of bent wood (fig. 6).

The chief difficulty in making a wheel of this kind must be in the driving of the spokes, but this is overcome by fastening a block of wood to the spoke with two broad clips, and hammering the top of the block.

There will be an undoubted gain in elasticity with such a wheel if the flattened part of the bent spokes can be kept bearing firmly on the rim, but in use the latter would probably come down. At present the maker only uses two rivets to fasten the spokes down, but a long plate like a felloe-plate fastened to both spokes and felloe, and with a rivet or rivets to go right through to the tire, would appear to be a better plan for preventing the spokes either moving or flattening.

The principal coachbuilders in Paris import American bent rims in large quantities, but they prefer to use a home grown elm for the naves, and acacia for the spokes.

There is a growing practice amongst them of morticing their spokes into the nave without any stagger, *i.e.*, in a straight line, not in and out, as is customary in this country. They say it makes the wheel look lighter. They are right, but it makes the wheel weaker.

Instead of using the Warner hub, some French firms have adopted an imitation of the Sarven wheel. In the Sarven wheel there is no nave, the spokes forming a solid arch round the box, but the French method is to introduce a nave, and to make one or two minor changes, as shown by fig. 7.

It will be seen that there is a nave, but that the spokes rest against each other. There is an iron flange round their faces fastened by bolts. The bands on American hubs are fixed on under pressure. This is not available in an ordinary coach factory, so to prevent the band coming off through expansion, the French contract a hoop on to the nave, and secure it with screws or bolts, as indicated.

The wheels of the Swiss carriages, like some of those in the French department, had the spokes entering the rim or felloe exactly at the junction of the two ends. This keeps up the joint, but there is nothing except the rivets through the tire to prevent the joint opening lengthwise. In addition to this, the Swiss follow an old-fashioned plan in inserting a rivet right through the joint, taking the tenon of the spoke in its course, and they also sink the burrs in the wood, so that they may be flush and out of sight. Their nave-hoops were very showily silver-plated. All the known sections of tire bar were to be found on the French carriages. There was also a new shape, in which the edges of the bar formed a right angle; thus, a lip projected over the felloe on each side to protect it.

The wheels of the Forder hansom, in the English section, were, as a matter of course, fitted with the indiarubber tires, for which the Shrewsbury-Talbot Company have secured the patent rights. This form of tire compares very favourably indeed with one that was shown in the French section. The French wheel was hooped with square Channel iron, and round the indiarubber was fixed another hoop of iron, with lips or flanges, covering for a short distance the indiarubber, but leaving a clear space between the two iron tires. As the indiarubber was merely fastened with solution, and as the flanges of the Channel iron were so shallow, it was difficult to understand how the outer tire was to be retained in position after the wheel had been used a short time, for it appeared almost certain that when there was weight in the carriage, and it was running over rough and uneven surfaces, the compression of the indiarubber would cause the outside tire to work loose.

Mons. Kellner has invented a tire which appears to offer some advantages over those of indiarubber. The wheel is hooped with Channel iron, and in the hoop are closely dovetailed pieces of leather, which form a half-round tire on the outside. M. Kellner claims that it is cheaper than indiarubber, inasmuch as the material of his tire is composed of scraps of washer-leather, and he also demonstrates that it is much more durable than indiarubber. His private brougham has been fitted with a pair of hind wheels—one having a tire of indiarubber. and the other a tire of leather. The leather has worn out two tires of indiarubber, and yet shows little evidence of wear. This is conclusive, for there is nothing like a practical test, and, moreover, M. Kellner argues that the draught is lighter with leather than with indiarubber—another assertion it would be difficult to refute.

N.B.—The French import duties cause indiarubber to be very dear.

While there were many perch carriages shown in the French department, there was not one in the British section. There were, however, numerous examples of the modern imitation cee-spring applied both to two and four wheeled carriages.

The landau exhibited by a well-known London firm was hung, like the remainder of their carriages, on their patent combined cee and elliptic springs, which necessitate the body being hung very high. When the carriage is fully loaded, it must, of necessity, be easy, owing to the extraordinary length of the springs, which project some 12in. or 14in. beyond the hind wheels, and this, notwithstanding the fact that the wheels exceed the average height. Those springs are well made, carefully drawn, and fitted.

In the French section the imitation cee-spring was only to be found on one or two carriages, and there was a pair on a hooded gig from Brussels. The ordinary elliptical forms, either in five springs or in simple elliptics, with either close or open heads, and the cee and under springs proper prevailed throughout. Some of the heavier springs, instead of having slots and nibs, had tapered ribs running down the centre of each plate—a plan invented by Mr. Cary, of Manchester, but it is evident to anyone that it must stiffen the spring and prevent its elasticity coming into play when it is deflected.

The shape of English spring-plates varies very little, but the visitor to the Exhibition would infer that they vary very much in France. Every variety of form, from the ordinary round and spear points to those terminating in small squares and circles, might be seen. It must not be supposed, however, that these are used in ordinary everyday work. They were got up for Exhibition purposes. Many of the springs had plates with bevelled edges—a plan that shows off the varnish to advantage. The bevelling is done on the same large stones as the grinding. The majority are machine-made, and come from such establishments as those of Lemoine and Anthoni.

There is no doubt that the manufacture of carriage-springs has been carried to a remarkable degree of perfection in France. In ordering springs, a coachmaker not only gives the required dimensions, but he stipulates for a certain deflection with a given load. There are firms of steel and spring manufacturers in the North of England who make springs in the same way, but their productions are not generally known to coachbuilders. So accurately are the dimensions calculated by the makers that the foreman or store-keeper, on receiving an order for steel, merely turns up his table-book and gives out the necessary quantity of plate, and no more.

It is pleasing to notice that the French and Belgian makers

give practical effect to the rule that the thickness of spring-plates should decrease in proportion as their length is reduced. Thus we commonly find four different gauges of steel used in one spring, while at home we seldom use more than two. As a rule, the plates of French springs are wider and thinner than the English, and they are not middled, *i.e.*, hollowed down the centre to bring the edges to a bearing upon the plate below. They are ground perfectly flat, and bear one upon the other throughout their width. For general workmanship and finish the French springs are superior to anything that is produced in England at the present time, but there is no reason why this should be the case. They cost from 1d. to 2½d. per lb. more than those of home manufacture.

The Cab Company's exhibit included a spring twisted and bent in a manner, suggestive of "mild," rather than of ordinary, spring steel. To believe the statement of the attendant that the steel had been thus distorted *after tempering*, was too great a tax upon the credulity of the visitor.

Some of the spring centre bolts were very light, not more than $\frac{3}{16}$in., while others were very heavy. Many were countersunk into the back-plate, which must have been weakened very much. One builder used springs, with slots at the ends of the plates; but the utility of this plan was not apparent.

The springs were commonly bolted, instead of being clipped to the wheel-iron heads and to the pump-handles. In some cases bolts with very neat, oval, and diamond-shaped heads were used for this purpose. The double clip, with a flat-plate connecting the two sides at the top to keep them in position, was very widely employed.

There are about 125 carriage manufacturers, and 253 builders of commercial vehicles in Paris, without counting the members of the various accessory trades, which are much more numerous in France than in England. Bearing this in mind, one would expect to find some individuality in their under-carriages, and particularly in perch-carriages, but a monotonous similarity, both in form and dimensions, prevails throughout. There is no coachmaker in Paris who produces his own cee and under spring carriages. They are made entirely by such firms as Lemoine, Anthoni, Bail Pozzy, Hannoyer, and others. There are also numerous firms in Paris who neither iron the bodies they make, nor produce their own wheels and under-carriages. This, as well as the hanging of the doors and fitting of hinges, is done by the coach ironer. Here are a few prices paid for this class of work :—

Ironing a brougham, including the fitting of doors and edge-plates, supplying wheels and carriage complete ... .. 1,100 francs.

A landau	same work	1,360 Francs.
A mylord	ditto	1,100 ,,
A cabriolet victoria	ditto	1,300 ,,

The head-joints are not supplied by the carriage-ironer; they are provided by the coachmaker. A mail coach costs 2,600 francs to iron, including brake and all ironwork. This is considered very cheap.

The prettiest perch-carriage in the Exhibition was the cee-spring victoria in the Dutch section. This under-carriage was a marvel of elegance, lightness, and strength, the workmanship being of a very high order. The perch conformed to the lines of the body in a manner seldom seen, and it afforded a striking contrast to those in the French department, which were much heavier (as, indeed, all the ironwork was) than those used by the leading firms in this country. In the hands of French or English painters and trimmers this carriage would have created a sensation.

Since the Exhibition of 1878, when they generally used full English wheel-plates, the French have returned to the use of the half wheel-plates. Most of the exhibitors adopted fixed perch-bolts, presumably to prevent rattle, and in one carriage it was fixed to the bottom of the footboard, a plan that must cause much vibration. The wheel-plates were, in some instances, kept entirely clear of the transom-plates, and thus rested completely on the short felloe-piece and hind-plate. This cannot be so steady as the ordinary method. It is perfectly correct to keep the perch-bolt socket clear, as many did, but it seemed too high in some cases.

Although iron futchels were first used in France, many of the carriages are still fitted with those of wood, notwithstanding their heavy appearance and liability to rot.

Some of the wheel-irons were given most objectionable forms, which not only increase the difficulties of forging, but detract from their strength, and increase the risk of breakage.

The theory of interchangeability in carriage-parts could not have had abler exponents than the Cab Company of Paris. When they introduced their iron panels, some 12 years ago, grave doubts were expressed about the feasibility of the plan, but their experience, which is probably more extensive and varied than that of any other similar company in the world, has shown those doubts to be unfounded. All their broughams and victorias are now said to be panelled with iron. At the recent Exposition they showed what can be accomplished by interchangeability, and every thoughtful person connected with the manufacture of carriages devoted a more than ordinary degree of attention to their exhibit. Their under-carriage (shown by figs. 8 to 16) might, with justice, be said to have been as near perfection as possible. It was composed

of small pieces, easily taken apart and replaced by others of precisely the same form and dimensions.

At first sight it would appear a contradiction of the theory to make the hind cross spring-stay and the pump-handle all in one piece, but a moment's thought reminds us that repairs to those parts are seldom needed, and there is a manifest advantage in having only one foot instead of two, thus reducing both work and weight. Another example of the growing practice of making several pieces, such as scroll-irons and steps, from one piece of iron was shown in the double-coach referred to on a previous page.

Speaking generally, the French coachbuilders do not follow up the idea of interchangeable parts. For instance, there is a considerable saving in time and expense if a dogcart under-carriage can be repaired without "unhanging." The French builders seem as though they preferred to risk unhanging any carriage that needs repairs. In one case the hind-scroll, the shaft-end fastener, and the brake roller-socket were all forged in one, and in another the shaft-fulcrum, the front scroll, and the step.

The Roumanians showed a very light spider phaeton, hung on the American principle, with a perch, but the elliptic-springs were not attached to the body. A grasshopper-spring was clipped to the top of the elliptic. Attached to the ends of the grasshopper, by shackles, there were elbow-springs, which took the tops of spiral-springs resting on the horn-bar. The motion of this carriage, when loaded, was particularly buoyant, and the body being so far removed from concussion, would be very easy.

An omnibus was shown in the French department with a cross-spring, the back of which was separated from the second plate by three ¼in. blocks between the two—one in the centre, and one at each end. The object of this was not evident. The shortness of the second plate threw an unnecessary strain upon the back. The carriage-steps, both fixed and moveable, were well designed and well made. The sizes and shapes of the stirrup-steps were admirable. Folding-steps to work with the doors of closed carriages have fallen into disuse, owing to their straining the door. Numerous steps, intended for the convenience of ladies, at the front of mail and sporting phaetons were made to fold and slide under the body, or into the boot. There was an excellent curved step-ladder, which was fixed in sockets, either in front or behind, and which terminated within an inch or two of the ground, thus reducing the risk of accident if the horses happened to be restive.

The French appear to be very particular about the safety of their carriage-axles. If they err at all, it is on the side of safety, the axles being invariably heavier than those used by English coachbuilders. The Omnibus Company of Paris follow the same system

LIBRARY
DEC 1 1930

as some of the English railway companies in withdrawing an axle from use after it has run over a certain distance. The Omnibus Company exhibited broken axle-arms to show the stage of crystallization of the iron after running 17,500k. and 108,000k. As a rule, they do not use axles which have run more than 7,000k. or 8,000k. This is a wise precaution in the case of the ponderous vehicles used for the service of the public in the French capital. Many of the axles of landaus and other carriages are cranked just sufficient to bring the top of the spring flush with the axle-arm. Several of the French axle-makers showed the solid flaps in some new and good positions. One Parisian builder exhibited a new form of "Collinge" axle with a partially-tapered arm, and he claims that leather-washers are unnecessary when his improvement is employed.

In the application of brakes for retarding the motion of carriages, the French are immeasurably behind the English, except that in some of their heavier carriages they are beginning to adopt the most powerful brake that is known. It was invented by M. Lemoine some five years ago, and works on the principle of the capstan, the revolving wheel itself conveying the force necessary to retard its own momentum. It is now very generally applied to omnibuses and tramcars, for which it is admirably adapted. The exhibitor of the pivotted axle is now utilizing it for private carriages by employing a thin wire instead of a thick hempen rope. It is plain that the manifold advantages of this brake, chief of which are the immense retarding force that can be exerted by a very small expenditure of power, and the absence of strain upon the body-plates of the carriage, are now being fully recognised. There were several other forms of the nave-brake exhibited, but in efficiency and simplicity they cannot compare with the above. Ordinary tire brakes on French carriages are usually applied by means of the screw-wheel—a very powerful, but a very slow method.

Brake-blocks were either of cast or wrought iron or wood, and were set to suit the newly-hooped wheels; not pivotted to allow for wear and tear at the top or bottom of the block. In several instances they were fitted too low, and would come too far from the wheel when the carriage was loaded, and when the brake was most needed.

Indiarubber blocks appear to be almost unknown, as one firm exhibited a model to show the relative merits of iron and indiarubber for this purpose. They claimto be the inventors of the block—a somewhat startling assertion.

In the Exhibition of 1878 there were shown several methods of balancing the weight of the body on the shafts of two-wheeled

carriages, but there was a remarkable paucity of such exhibits in 1889. There were no methods of accomplishing a balance except by moving the seat with a screw.

The brakes of all two-wheeled carriages, whether worked by screw or lever, and whether applied to the tyre or to the nave, throw weight on to the horse's back, and are worse than useless. The French appear to be no more successful in the application of shaft-fittings to reduce knee motion. Those shown with springs at the back were so heavy that they afforded no more relief than the lancewood itself.

PAINTING AND TRIMMING.

It is in the decorative arts of painting and trimming that one naturally expects to find the French coachbuilder at his best. Fashions decrees everything in Paris, and, as a consequence, there are prevailing styles of trimming from which very few of the coachmakers deviate.

A remarkable piece of work was shown in a brougham painted olive-green, with a black under-carriage striped with the body colour. It was trimmed with a corresponding shade of silk plush, the entire lining, with the exception of the cushions, being worked in diamonds. The back, from top to bottom, was worked in this way with pipes in the centre. The top-quarters were in diamonds of the same size as the side-squabs, and the front and the roof were treated in the same way. There were two rows of buttons on the top finished in diamond form, and a piping with one row of buttons above the cushion. The doors and falls were worked in diamonds with a lace border, and the blinds were of the same colour as the plush. This method of treating the backs, roofs, and doors is very general in Paris, and it is certainly very effective.

We had in this carriage an example of that admirable harmony in colour for which the work of the French trimmer has long been famous. In the English section there was a brougham similarly painted as to colour, and trimmed with a similar material, but a comparison of the two carriages at once revealed the mistake of the London trimmer. His plush was equal in quality to the French, the design of his trimming was very neat and tasteful, and the workmanship would not suffer by being compared with anything in the Exhibition, but the *shade* of the plush—a very pale blue green—ruined the otherwise excellent work. It neither harmonized nor contrasted with the olive-green of the body.

Another example of the prevailing styles was a d'Orsay, shown by one of the best known houses in Paris. The body was black, with a yellow line on the mouldings and the bracket. The under-carriage was a very rich dark-green, striped only on the front and back of the naves (a method which has been very adversely criticised by English coachmakers), and on the face of the spokes with a half-inch gold line split by a hair-line of black. The driving-seat was trimmed with plain black cloth, bound with black plush, and the driving-cushion had full round rolls. The seat-fall was entirely plain with a stitched border. The interior was trimmed with old gold figured silk, the curved side squabs and back being decidedly English. The upper part of the squab was composed of diamonds, the centre plaited, and the lower part worked with buttons down to the cushion-top. The upper quarters and roof were plain, with lace borders of a remarkably neat design. In all cases the quilting was very full. Seat-falls were usually plaited; many having round plaits separately formed and sewn on to the plain fall.

There was only one carriage (a bijou brougham with concave front) painted and trimmed in French grey, a colour that used to be largely employed. This carriage had glass panels in the quarters, and showed some excellent work in the painting and trimming of grey, white, and black.

Cloth was rarely seen in anything but the mail coaches. A very light coach was plainly trimmed with drab cloth bordered with a plain band of embossed brown leather lace. Satin and striped silk and plush were widely used. Pig skin, or rather an imitation of that leather, was utilized for the outside trimming of mail coaches and semi-sporting carriages, but it is obviously the most unsuitable material that could be employed, owing to the worn and stained appearance imparted to it by a little exposure and rough usage. Each carriage shown by one particular firm was trimmed with the same pattern of lace; a plain stripe, evidently supplied to them in many different colours.

The trimming of the Swiss and Austrian carriages was neat, but there was nothing in the materials or workmanship to call for special comment. The brougham from Zurich, was upholstered in satin of a very rich shade of dark green, which harmonized well with the painting of the undercarriage. Owing to the situation of the Swiss exhibit above the heat and dust of the machinery, the carriages could not be expected to present the same attractive appearance as the vehicles in the more favoured French and Belgian sections.

The trimmings of the English carriages were of ordinary standard styles. There was nothing whatever in the Exhibition that cannot be seen at any time in the streets of London. The

workmanship was unexcelled, but there was not the same variety of material employed as in the French exhibits. It is not likely that those elegant fabrics, so easily injured, will find favour in this country, nor would our carriage users incur the expense of the beautiful accessories to be found in so many Parisian vehicles. Many of these little works of art in carved ivory and ebony, and in silver and gold, add from 600 to 1,000 francs to the price of a brougham.

The painting of the French, Belgian, and Austrian carriages could only be characterized as *excellent*. Dark colours, both in bodies and undercarriages, predominated. The light coloured undercarriage, formerly so common, is very rarely seen at the present time. With a few exceptions there was not very much striping on any of the carriages. Some had no edging whatever. But there were some very bold and very successful innovations in relief painting.

One mail phaeton body was entirely black, excluding the straight rockers, which were red.

The yellow panels of a mail coach were striped at regular intervals with three narrow lines of light brown.

The rockers of another mail coach were yellow edged with a narrow black line. The mouldings were black and the panels were red. The bracket and the door in the hind boot were yellow. The frames of the German shutters were of rosewood, while the panels were yellow striped with black. The mouldings of the roof box were black and the panels yellow striped with half-inch black lines. The undercarriage was yellow, striped with black.

A very prevalent practice is to stripe the nave with a single broad line on the front and back, *e.g.*, dark green wheels with the hubs striped with two broad bands of vermillion. This plan certainly brings into prominence the heaviest looking part of the wheel, but the effect is not displeasing. The sides of the spokes are seldom edged, but as a rule the dark colours are brightened up with one or two broad lines on the face. Some springs are striped round the edges of each plate.

In the Belgian section there was a mail coach which ranked with the best painted carriages in the Exhibition, and this vehicle was the product of a coachmaker who manufactures his own varnish. This gentleman stated that he purchased the recipe from an English maker some years ago, and has made his own ever since. If this be true the Belgian coachbuilder made a profitable investment. The wooden dasher of a mail phaeton in this section could not have been distinguished from the best japanned leather except for the absence of stitching.

English and American varnishes are very generally used by French carriage manufacturers. Their Exhibition carriages displayed a general excellence in finish that has only once been approached in the United Kingdom, viz., at the Glasgow Exhibition in 1888.

Notwithstanding the doubts which have been expressed upon the subject, *hand polishing* of Exhibition work is practised by several Parisian coachbuilders. This is admitted by some of the builders themselves. It gives a solid marble-like look to their work at the expense of a little brilliancy. But no matter how much polishing may be bestowed upon a body, no matter how much of the French liquid may be used for preventing dust and dirt working up with the varnish brush in finishing, a carriage cannot be brought to that stage of perfection seen in the French and Belgian sections, unless the most scrupulous care has been exercised from the priming to the finishing coat.

In this connection the Parisian coachmaker is most exacting. Cleanliness and care are evident on every hand in his workshops, and his carriage is trimmed before it is flattened for the edging lines.

THE EXPORT TRADE OF THE FRENCH COACHBUILDERS.

The volume of the export trade of the Parisian carriage manufacturers has increased very much during recent years, and it has been a matter of some surprise that this should be the case, seeing that the French have not, in former years, been distinguished for pushing the sale of their productions in foreign countries.

The French do not import carriages to any appreciable extent, because of the prohibitive nature of the Customs Tariff.

American sulkies and buggies were at one time imported in considerable numbers, and as the import duties are regulated by weight the prices of those light carriages were not increased by more than £2 10s. each; but their popularity was only evanescent, and as their construction had been taken up by the French coachbuilders themselves, many of them are to be seen in the showrooms and workshops, where they have stood several years.

French coachmakers, like those in America, are *protected*, and however unfavourably this may affect the consumer it is certain that it is beneficial to the producer. Whether the advantage derived in one case counterbalances the evil inflicted in the other, is a matter for the political economist to decide.

It is impossible for the English manufacturer to carry on an export trade with France until he produces something that cannot be obtained in that country.

The following exorbitant duties are levied in France, and in the two countries with which their principal export trade is carried on :—

IMPORT DUTIES ON CARRIAGES.

FRANCE.

Carriages weighing 2½ cwts. or more, £1 0s. 4d. per cwt.; carriages weighing less than 2½ cwts., £2 8s. 9d. per cwt.; spring carts for trade purposes, 4s. 10½d. per cwt.

UNITED STATES.

Carriages of all kinds, 35 per cent. ad valorem.

ARGENTINE REPUBLIC.

Landaus valued at 1,400 dollars or patacons = £145 16s. 8d., 45 per cent.; broughams valued at 1,100 dollars or patacons = £114 11s. 8d., 45 per cent.; victorias valued at 800 dollars or patacons = £83 6s. 8d., 45 per cent.; wagonettes valued at 500 dollars or patacons = £52 1s. 8d., 45 per cent.; gigs valued at 300 dollars or patacons = £31 5s., 45 per cent.

At the present time French carriage manufacturers are carrying on a very considerable trade with America, but more particularly with the Argentine Republic, although they are confronted with a duty of 35 per cent. ad valorem in one case, and with a tax of 45 per cent. on a fixed valuation in the other.

It will be seen that the fixed values upon which duty is levied in the Argentine Confederation are very moderate, but the tariff is even more illiberal than that of the United States.

We may fairly ask how it comes that the French are able to outstrip us in these two instances ? Our prices are as low as theirs. We have a mercantile marine unique in the history of the world, and can, without doubt, obtain more favourable freights than are possible from any of the French ports.

It must be admitted that they have paid more attention than we to the packing of carriages for transit, with the result that this has become a trade in itself, and the work can be done more expeditiously and at a smaller cost than with us. One firm in Paris has a patent case in which they pack a carriage for transit to any part of France for a moderate charge, receiving, of course, the empty case when it is returned. It is customary to take off the wheels of carriages going by rail, to prevent injury to the axles. Carriages for export are almost invariably packed in *one* case, and this is often a disadvantage in shipping, where 40 cubic feet may, at the option of the shipowners, be charged as one ton. If the shafts of some carriages were packed in the same case as the body, there would be an unnecessary increase in the cubic measurement.

To avoid this some English manufacturers make two or three compact packages of one carriage.

The American trade of the French is explained by the fact that in New York and other large centres there are certain wealthy classes who prefer to follow Parisian fashions, both in carriages and dress, and they do not hesitate to pay much higher prices than would be necessary to obtain articles equally good in their own country.

In the case of the Argentine Republic the French manufacturers have shown a most commendable spirit of enterprise.

The Argentine Confederation has great natural wealth. Its area is 515,700 square miles, and its white population a few years ago was only 1,736,922. In recent years there has been a tide of immigration, which is causing a rapid development of its vast resources. A complete network of railways has been constructed, and in the chief towns, but principally in the capital Buenos Ayres, there is a growing demand for carriages of all kinds, from the pony phaeton to the public omnibus. Horses are very cheap, while wood, iron, and coals are scarce, and this has led to the construction of a tramway 200 miles long. Their proximity has given the Americans a decided advantage in supplying the market; but the French manufacturers have now got special representatives and travellers in the country, and by dint of producing a style of vehicle calculated to meet the peculiar requirements of the people with whom they are dealing, they are now reaping a substantial benefit. In the Summer of 1889, one firm in Paris was engaged on an order for nearly 100 carriages for Buenos Ayres and the neighbourhood.

The French coachbuilder does not advertise to the same extent as the English manufacturer, but appears to prefer special and direct representation as a means of promoting trade.

This is the opinion held by the majority of our consuls in foreign countries. The reports, which they submitted in response to a Government enquiry a few years ago, were unanimous in urging British manufacturers to adopt the methods so successfully practised by the French, the Germans, and the Americans, whose representatives are to be found all over the world. Were this advice acted upon, it is probable that British carriage manufacturers would secure the major portion of the work that is now being executed in other countries.

THE TECHNICAL CLASSES OF PARIS.

While the value of technical education is being so widely discussed in this country, it is interesting to note its application amongst French coachbuilders. The valuable results of that application are plainly visible in the general excellence of the work they showed at the Paris Exhibition.

It may be fairly said that coachbuilders were amongst the first manufacturers in this country to realise the advantages to be gained by an education in their special art; an education that would enable them to apply the principles of science which bear upon their handicraft. But we have not attained such gratifying results as are evident in France. The cause lies in the difference between the measures of support accorded to the classes in the French capital and those in this country, and in the fact that the French were several years ahead of us in putting the matter to a practical test.

There are three technical classes for coachmakers in Paris. The two principal classes are those of the Syndical Chamber of Coachmakers, 22 Rue Langier, and of the Association of Workmen, 35 Avenue Wagram. The former was established in 1878, and the latter six years previously. Both are in the neighbourhood of the Champs Elyseés, which may be taken as the centre of the coachmaking industry. The third class is held in the Rue d'Aubervilliers, and is attended by those engaged in the heavier class of work, such as the construction of trade vans and wagons and commercial carriages.

The classes are open five nights a week, from Oct. 1st to April 30th, the hours being from 8 to 10 p.m.

The principal subject of instruction is, as a matter of course, drawing in its application, not only to the construction, but to the design and ornamentation of a carriage.

The maximum term of instruction for each pupil is fixed at three years. One evening per week is devoted to oral demonstration, and at the masters' school this is given on Tuesdays.

There are two divisions in the course of study, one for smiths, wheelers, vicemen, etc., and the other for body makers.

In the former division the subjects for the first year are—linear drawing, geometry, and lessons in wheelmaking.

The second year is devoted to the nature and properties of woods of various kinds, their relative strengths, stiffness, etc.; the nature and properties, uses and application of iron, and its various resistances; the construction of under-carriages, etc.

The subjects taken up during the third year embrace "the suspension of carriages," methods of determining the position of under-carriages, the equilibrium of loads, traction, etc.

In the bodymakers' section the course of instruction during the first year consists of lessons in linear drawing, and in plain and solid geometry.

The second year is allotted to special instruction on body-making, the nature and properties of timber, the practical application of geometry to body-making, and the making of drawings to a scale of one tenth.

During the third year the student is mainly engaged in the preparation of full sized working drawings.

It will be seen that the chief difference between the French and English classes consists in the division of the subjects to be studied by workmen engaged in different branches of the art. Indiscriminate teaching must always be unsatisfactory, and experience has proved that this division is not only beneficial but necessary to success.

The working drawing copies used by the pupils are produced by M. Albert Dupont, who makes his original drawings to a scale of one-third. These are reduced by photo-engravure to a scale of one-tenth. The reduction can be regulated with the strictest accuracy, and the method has the advantage of showing all details (even the head of a bolt in an undercarriage), to the proper scale, which would be nearly impossible were the first drawing to be made to the reduced size.

The city of Paris contributes 5,000 francs per annum to the Association of Workmen, for the purposes of technical education, and the Minister of Commerce gives something like 2,000 francs to the Chamber of Coachmakers for a like purpose.

Those amounts do not nearly serve to pay the expenses of teaching, rent, and other things, and the balance is therefore made up by the coachmakers and by the workmen respectively.

At the class which is carried on under the auspices of the employers, the students pay a fee of two francs per month, and at the class of the Workman's Association the fee is three francs. All this goes towards the formation of a fund for prizes, which are awarded at the end of each session.

The teachers, who are usually foremen in one or other of the Parisian coach factories, receive a salary of 400 francs per session for their labours. This is fairly good remuneration, but it is not so large as that received by one teacher in the United States, where the Coachbuilders' Association pays between 600 and 700 dollars for the services of a professor of coachbuilding. On the other hand, teaching in England, or at any rate in the provinces, is entirely voluntary.

The students at the French classes have occasional lectures from the professors and teachers at the various colleges, in the same way as the pupils at some of the technical classes in England.

Those lectures are not lessons in coachmaking, but embrace "mechanics," and kindred subjects of science bearing upon the work of the coachbuilder, and which, when rightly applied, enable him to pursue his craft with the most beneficial results.

THE CARRIAGE TAX IN FRANCE.

Although the taxes imposed upon carriage owners in France are very much in excess of those levied in England, they do not appear to exercise the same baneful influence on the trade.

The manufactories and showrooms in Paris are well stocked with carriages, but we do not observe that excessive crowding which is evident in too many British factories.

Upon vehicles running in a regular service from one point to another, such as the tramcars and the omnibuses of the General Company, the State imposes a tax of one-tenth of the price of the places, and this duty is based on the supposition that each place is occupied once during the journey. It is well known, however, that such a supposition is prejudicial to the interests of the company, as in an ordinary way the places are seldom all filled, and it has even been said that the tax is equal to two-thirds of the total price of the places.

The taxes on hackney coaches are as follows, viz.:—

For a carriage	with seats for	2	passengers,	40	francs per annum.
ditto	,,	3	,,	60	,
ditto	,,	4	,,	80	,,
ditto	,,	5	,,	96	,,
ditto	,,	6	,,	110	,,
ditto	,,	from 6 to 50	,,	10	francs additional

In Paris the taxes on private carriages are :—

For a vehicle with	4	wheels	60	francs per annum.
ditto	2	,,	40	,,
For a horse			25	,,

Carriages and horses used for commercial purposes, such as the conveyance of travellers and agents, are assessed as follows, viz.:—

A vehicle with	4	wheels	30	francs per annum.
ditto	2	,,	20	,,
A horse			12f.50c.	,,

In the other towns of France the amount of the tax is regulated by the number of inhabitants. The rates of duty are as follows, viz.:—

	CARRIAGES.		HORSES.
	4 wheels.	2 wheels.	
In a town of more than 40,000 inhabitants	50f.	25f.	20f.
,, 20,001 to 40,000 ,,	40f.	20f.	15f.
,, 10,001 to 20,000 ,,	30f.	15f.	12f.
,, 5,001 to 10,000 ,,	25f.	10f.	10f.
,, 5,000 and less ,,	10f.	5f.	5f.

THE CONDITIONS OF LABOUR IN PARIS.

There exists in Paris a tribunal, called the Council de Prudhommes composed partly of workmen and partly of employers, who decide any differences existing between masters and men.

The labours of the Council have always had the most gratifying results. Any difference with a master respecting a carriage is referred to an expert, chosen by the common consent of the parties interested. The emoluments of the expert are in proportion to the importance of the case in litigation, and are paid by the Syndical Chamber of Coachmakers.

This is neither more nor less than arbitration, as we know it in all the chief industries of this country. In the North of England it has been for many years the principal, but not always successful, method of settling trade disputes.

It is recognised in France as well as in England, that a council composed of equal numbers of the interested persons cannot well be free from bias, one way or the other, and the aid of an independent judge, therefore, becomes indispensable.

The *average* wages earned by workmen engaged in the manufacture of carriages in Paris are:—Bodymakers, 7 francs per day; wheelers, 7 francs per day; smiths, 9 francs per day; painters, 6 francs per day; and, trimmers, 6 francs per day.

A Parisian workman with two children generally occupies a house or flat of two living rooms, and a kitchen, for which he pays a rent of 400 francs per annum. This, of course, depends upon the income and position of the workman. It must be taken as a general statement, as the home life and customs of workmen vary almost as much in France as they do in this country.

The Parisian workmen usually take three meals per day, two breakfasts and his dinner, but very often he omits one of the former.

He works 10 hours per day, usually from seven o'clock in the morning until six o'clock in the evening, having one hour for the mid-day meal.

In Paris, or at any rate amongst coachbuilders, there is a lack of that punctuality which is so striking a characteristic of English manufactories. If a French piecemaster lingers two hours over his meal and his bottle of wine at the café, his helpers or assistants follow the example, and will work until seven o'clock in the evening, to make up the time wasted during the day.

The Parisian artizan is not burdened with too many holidays. He works both Saturday and Sunday, except when one of these happen to be a *fête* day. Such holidays are scrupulously observed. From them the artizan extracts the greatest possible amount of enjoyment. In the evening he and his family dine out at the café, very often at considerable expense, and, notwithstanding the encomiums that have been lavished upon him for his sobriety and

industry, he very closely resembles his English fellow in the tendency to abstain from bodily exertion during the next day or two.

When questioned on the subject of Sunday work, the French coachbuilder says that his men do not work on Sunday unless there is a press of work, but as there are several establishments in Paris where there had not been a holiday for six months previous to the visit of your reporter, we must either infer that trade is exceptionally brisk, or that Sunday work is very general.

The large stocks of carriages to be seen in the principal establishments confirm the statements of their owners that trade is quiet, and, however anxious the Frenchman may be to conceal the fact from the foreigner, it is very plain that the general holiday, when one is taken, is Sunday afternoon.

It is not difficult to understand that men living and working under such conditions must spend what little leisure they have in the pursuit of enjoyment. There is not time for church-going, but, to their credit be it said, they have a keen appreciation of the fine arts. The French workman himself is responsible in no small degree for this condition of affairs.

Twenty-five years ago his wages were very small. He had no Sunday clothes, and, as he is highly sensitive, and in possession of a very justifiable amount of pride, he stayed at home on Sundays, ashamed to be seen in the streets in the same apparel as he wore in the workshop. Growing tired of this, he went to work instead, and has since continued to do so, although his condition has very much improved in the meantime.

The French and the Belgian workmen have not made the same progress towards the improvement of their social condition as the English artizan.

They have not yet attained to the powerful trade and friendly societies of Great Britain and America.

It must be admitted that the condition of the French workman is superior to that of the German, who, in turn, is very much better off than the Russian. In the latter countries the truck system—long since abolished by the law of this country— is still allowed to exist.

An examination of the carriages at the Exhibition, in the showrooms, and in the streets of Paris, revealed the fact that although English carriage manufacturers may not bestow the same elaborate care as the French builders on vehicles intended for exhibition, we are in no way inferior to them in the general practice of our art; in bodymaking our methods of construction are superior to theirs.

From occupying a secondary position in some of the textile industries we have in recent times equalled, and, eventually, excelled them in more than one, and notably in the manufacture of carpets.

In concluding this report, I wish to express my obligations and thanks to M. L. Dupont, M. Francois Blondin, M. Brice Thomas, and Mr. C. A. Heergeist, the editor of the *Carriage Monthly*, for many services rendered with unfailing courtesy and kindness.

I am, Sir,
Your most obedient servant,
JOHN S. FOGGETT.

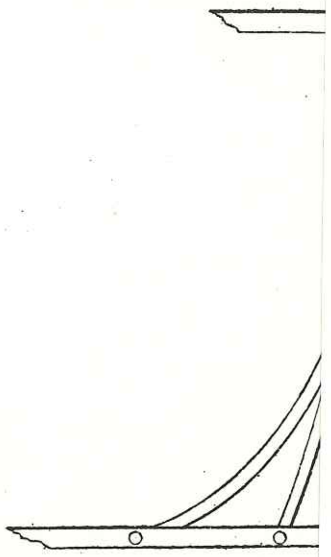


Fig. 1.

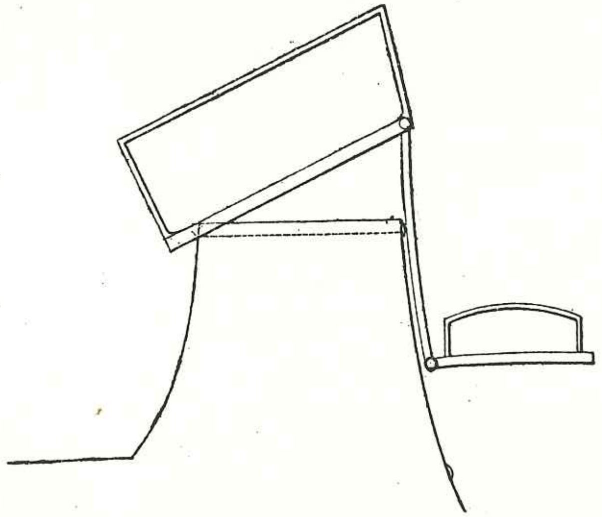


Fig. 2.

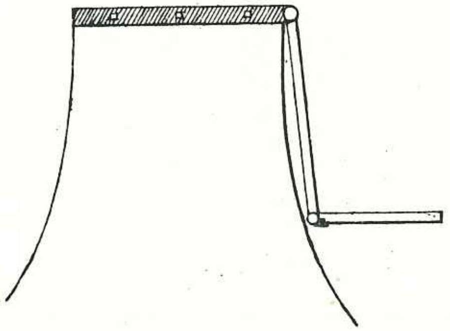


Fig. 3.

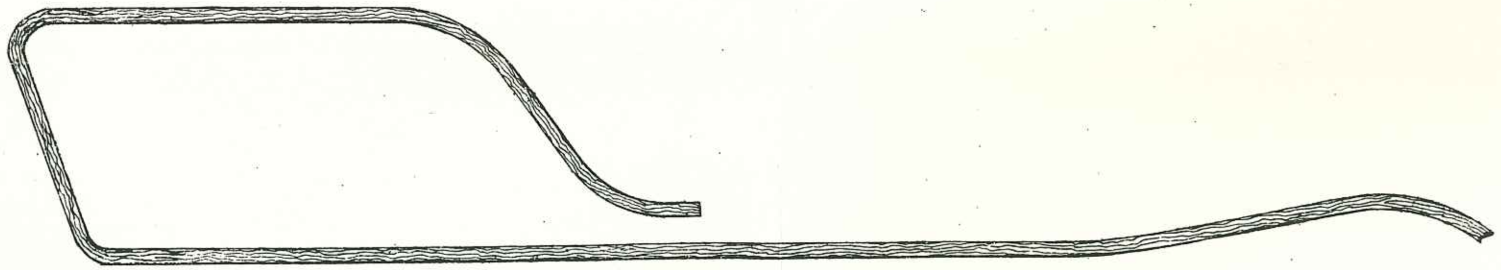


Fig. 4.

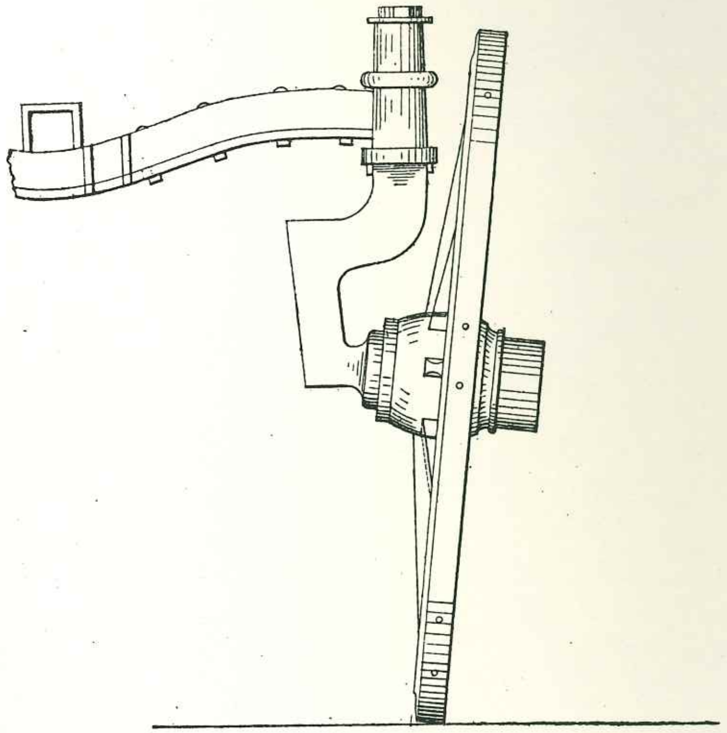


Fig. 5.

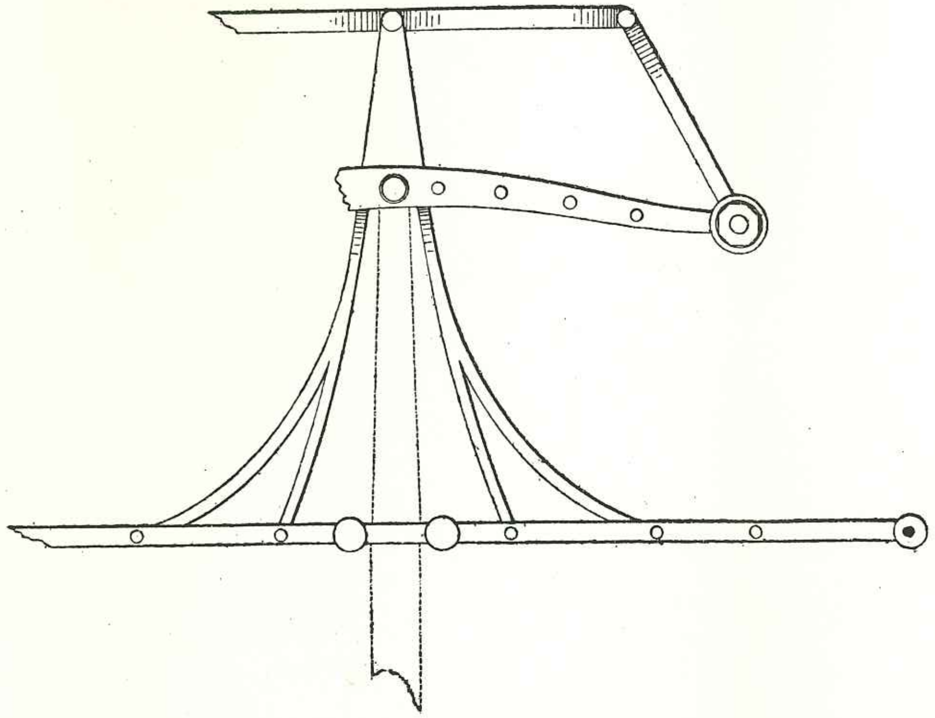
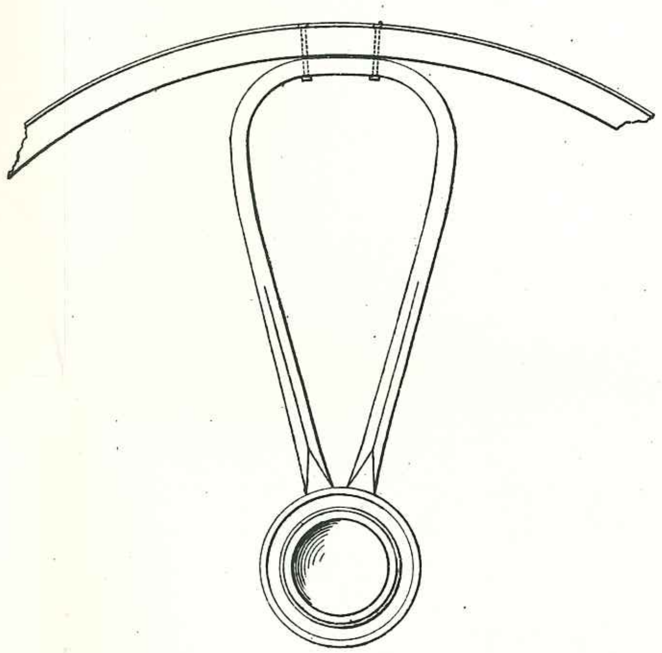


Fig. 6.



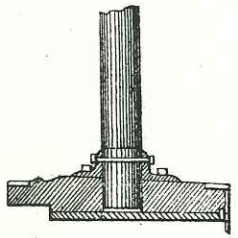
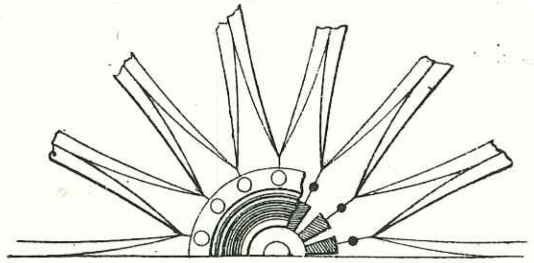


Fig. 7.



Lithographed by John Kemp & Co.

A REVIEW OF CARRIAGES

As shown at the Paris Exhibition, 1889.

SHEET 1.

Fig. 8.

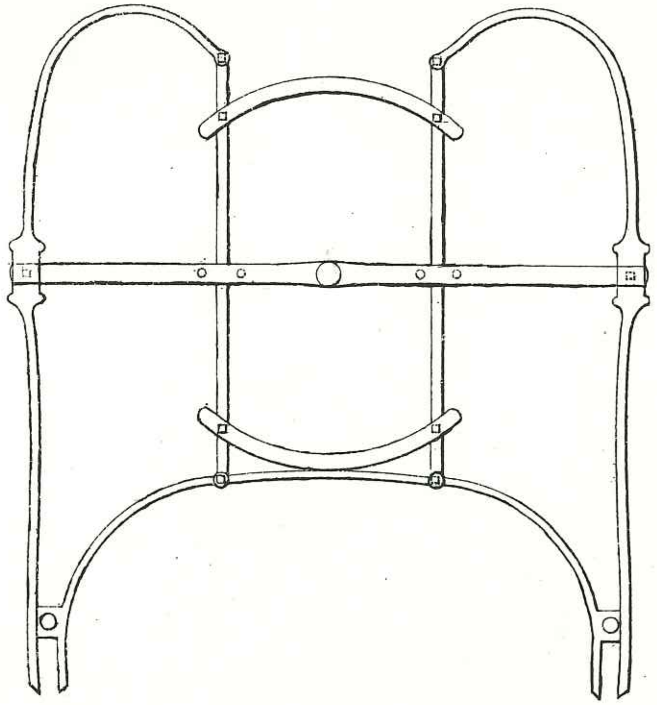


Fig. 9.

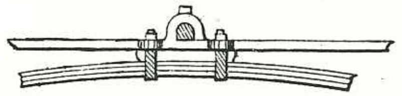


Fig. 10.

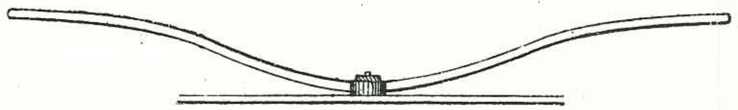


Fig. 11.

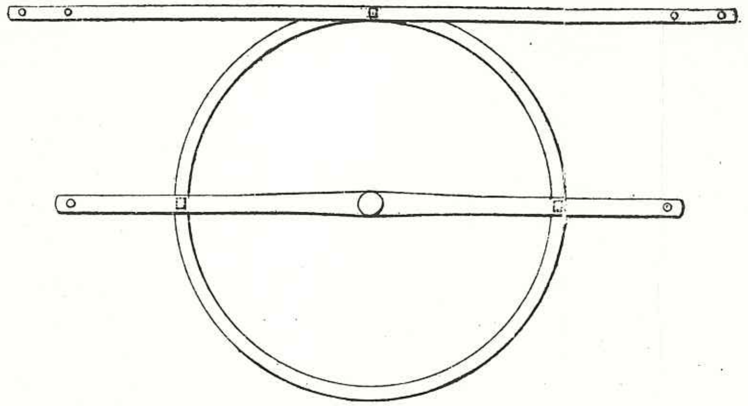


Fig. 12.

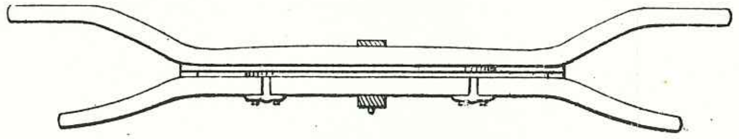


Fig. 13.

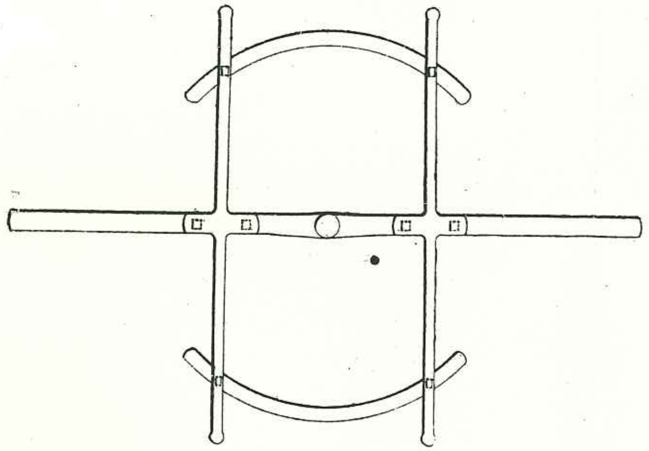


Fig. 14.

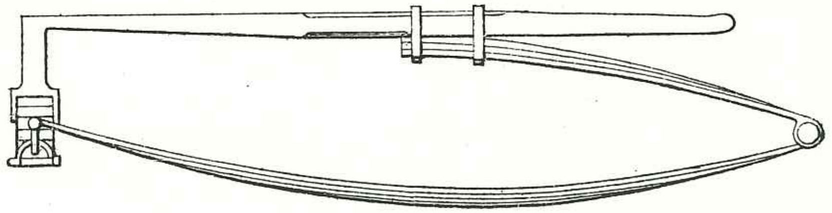


Fig. 15.

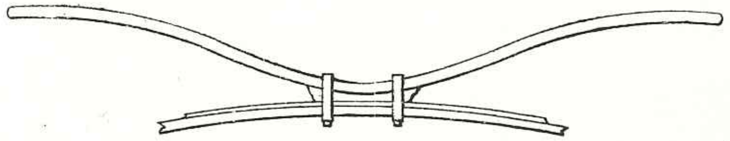
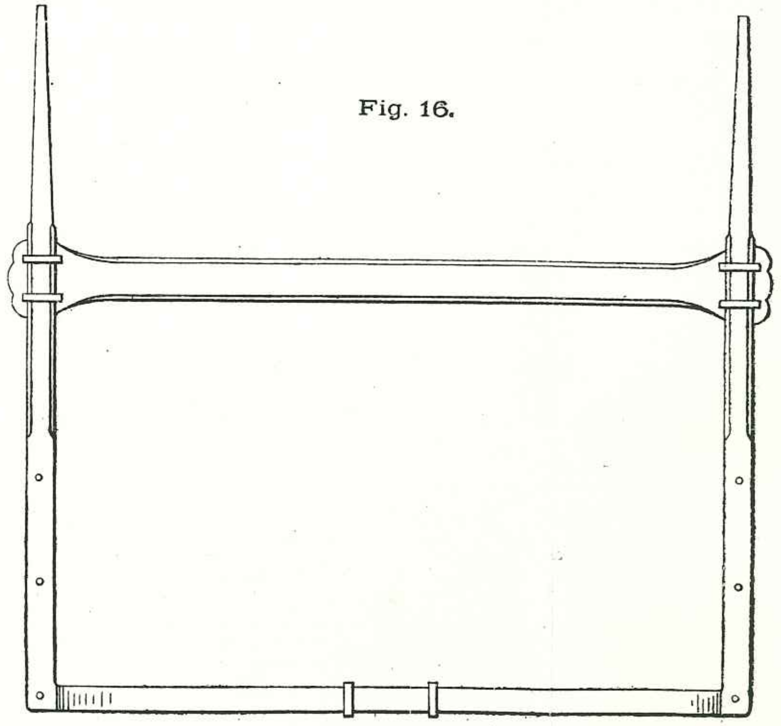


Fig. 16.



Lithographed by John Kemp & Co.

A REVIEW OF CARRIAGES
As shown at the Paris Exhibition, 1889.

SHEET 2.

ARTISANS' REPORT ON

CARRIAGE TRIMMING,

BY

EDWARD EVANS

(One of the staff of Messrs. Worger & Co., London).

TO THE INSTITUTE OF BRITISH CARRIAGE MANUFACTURERS.

GENTLEMEN,

Acting under your instructions of September 11th I proceeded to the Paris Exhibition to report on the trimming of carriages exhibited there.

On first entering the Exhibition I intended to take a description of the trimming of each carriage, and began to do so, but was compelled to stop through, I presume, some feelings of jealousy. The English carriages are placed in a very bad position at the end of the machinery hall, where the dust from working machinery has a very serious effect on the trimming. Although far from representative in their general character, they show a very great improvement in the trimming. It is evident employers and workmen are fully alive to the necessity of bringing this particular branch to a greater perfection, in order to meet the demands for a more artistic and a more highly finished carriage, and, in my judgment, they have succeeded to a certain extent. The work is very well executed, designs are good, and true to the purposes required. If there is a fault it is in the work being small and elaborate, imparting to the interior a somewhat crowded appearance, and detracting from that easy and luxurious form a carriage should possess.

The materials used are good in quality, the colours of laces and trimmings are well blended and in harmony with each other. I am very glad to record an absence of those objectionably bright

colours, too frequently seen at exhibitions, but very sorry was I to find such a scanty show of English carriages. Such is the improvement made in the finishing of English carriages that I feel certain that if we had had a representative display under proper management and supervision we should have stood well to the front, and been a credit to ourselves, a benefit to the trade generally, and to the community at large. In saying this, I refer more especially to export orders, as the demands for European carriages still stands very firm. A visit to the Royal Agricultural show at Windsor this year confirmed my opinion that we stand at the front, and that those who think otherwise are greatly deceived. There was one carriage at Windsor, which, for its general construction, mechanical arrangement, and beauty of outline, was not surpassed by any vehicle in the Paris Exhibition of 1889.

The French carriages I found in splendid and beautiful courts, highly decorated, and devoted entirely to carriage building, and the accessory trades. I very carefully examined the trimming, and found it of a uniformly good character, the whole showing good taste and very high finish, but very disappointing from the absence of anything new in designs or materials. The materials used by them are the same as ourselves, namely, morocco leather, satin, cloth, &c., and in only one case did I find silk plush. For cab-work, cowhide, imitation morocco leather, Bedford cord, and worsted plush. Upon closely examining their work I found that they have not made much progress, but have reverted to a quieter style. There is none of that fancy work, and that very elaborate detail, at one time so prevalent for the decoration of their roof tops, backs, and quarters. There is not the same amount of labour bestowed on work, and it appears to me from my practical knowledge that they are most certainly losing ground, whilst the English trimmer is making rapid strides in his art. In one case only did I see anything to command my special attention, and that was a victoria, built by Messrs. Bail Frères, Paris ; it was painted green, lined in drab cloth, and, with the exception of seat fall, which was pleated, was entirely plain without buttons or fullness. The elbows were straight in front with border, no fullness on top, quarters plain, with a pocket from back to front of body. The back, from the bottom to 14 inches up, was also plain and nearly flat, above that was a plain roll, about eight inches deep, to catch the shoulders. The cushions were made on a wood frame and springs, with a piece of lace across the frame front. The seat fall was pleated in diamonds, the whole looking very hard, and feeling so to the touch. Had the trimmer only added a pleated roll to top of back instead of a plain one, that and the seat fall would have given just sufficient relief to have made a fairly good job.

As there is very little that is new, it may perhaps be well to give an outline of their method of working. From what I gathered inside the Exhibition and what I saw in the various factories, a brougham is trimmed as follows :—When the trimmer gets the body he finds the back rail much deeper than necessary and not in any way lightened out. The cant rails are also deeper, and the pillars (heavier than ours) with a strip of deal nailed well back to the quarters battens, but on the pillars the full length of quarters ; also a back rail, such as we use to fix the back squab to. The French trimmer fits his canvas to the body in the same manner that we do, but does not cut it out, simply leaving the pencil marks of the framing on the canvas where the squab fits. He then sets them out for quilting, and most of the designs are in the diamond pattern. The carriages that were trimmed in satin had a piped back squab, with a row of half diamonds top and bottom, the designs were what I consider well balanced, being not too large or small, or disproportionately long or wide.

One thing struck me at once, that is that they follow a set style or fashion. All satin-lined carriages had piped backs the same size and pattern, and where this material is used the roofs are done in diamond pattern, ironed on the edges of the folds at the back, with two or three sheets of wadding between it and the canvas, very little fulness, and tufted in the usual manner. A great many still use, or have returned to the old fashioned tuft with a silk centre. After the trimmer has set his canvas out he cuts his materials to the exact size with the fulness allowed. If satin, he irons the fold of back, then proceeds to fix canvas to frames, laying a certain quantity of hair on, then comes the wadding, laying one sheet on top, he then applies the material, fixes his tufts or buttons in their proper places, regulating his quilting with folds turning down, and thus preventing dust getting into the work. Should the work be in morocco leather he folds it, and rubs it down on to the quilting lines at the back ; after this is done a very great advantage is to machine the crease on one edge of fold at the back of morocco for a short distance, say one inch from button-hole outwards each way, and when made on a frame it produces true work and retains the form of quilting, in the event of the back being sprung or subject to rough use. He then fixes his canvas to frames as he did for satin, fixing one row of buttons after the other, stuffing each row very lightly with soft grey hair, taking care that it does not show through the face of morocco. This method produces work that is geometrically correct, and clearer in form, but it loses softness of touch as compared with the system of laying the hair on the canvas, and is therefore suitable for quarters, top backs, and doorpads.

The back squab he serves exactly the same way as he did the satin one, but in both cases he ties his buttons in from the front nearly home leaving bottom and top open. He then takes it to the body in this state, and finishes top and bottom in body, regulates his quilting in body from the front with the strings left. Here again he differs from us with a little advantage ; we take our squab to the body finished, so cannot alter our quilting should we find it necessary.

The top back trimming is left open all round and finished in the body. The quarter trimming is finished at the back pillar on the bench, on cant rail at the top and at front pillar on to strips of deal, and on to the rockers at the bottom, a recessed quarter is thus obtained. In nearly all cases there is a pocket across the quarter from front to back, in front of edge plate.

Their spring cushions were made of a lattice framing of light covered steel with the springs in between, exactly similar to the method we should adopt with cane. I very much prefer our own method, as the slightest damp would certainly rust the steel and soon burn and destroy the canvas, and thus destroy the cushions.

French tastes seem pretty well divided between hand holders and swinging holders ; I much prefer the swinging with recessed quarters, as they fall well out of the way of the occupants and are easily within reach, and, being free, the entire length can be used as an assistance to get into the carriage, or as a rest without moving the body forward. Our own method of making them I consider superior to that of the French, who put a deal of fulness in the lining which when stuffed makes them appear very bulky, and for no good purpose. Our trimmer, with all his failings, is always very neat and tidy in finishing his holders.

The disadvantage of hand holders are, they increase the size of the pillar, which is already too prominent, are open to a lot of wear and tear, and bar to a certain extent the ingress and egress of the users of carriages.

In most cases the top back was plain in cloth or morocco ; in satin it was pleated. In some of the back-light pads there was a circular hole about 1½ inches in diameter, so that you could look back without exposing the face.

In all their broughams broad lace is used round the roof, as with us ; their door trimming was very flat and the work very neat (see fig. 1 and 2). The system adopted is as follows :—Width of broad lace and pasting are taken and set off on door casing. Inside that line they pin strips of half-round deal or cane ; the trimmer then fits his broad lace with the tape, edge inwards close up to the strips, he then turns his mitres and hammers them down, he then takes it off the doors, sews his mitres, and lays on one side till he fixes his squab, finishing it over the strips, and thus forming a recess to receive the broad lace, which he tacks close up to the strips; he then pastes down, finishing it off with ivory sleeker, and applies his pasting lace outside the broad lace to finish.

A trimmer will notice that by fixing his broad lace with the tape edge inwards he is able to sew his mitres before fixing to the door, and to hold the inside edge well down in its place without the use of any trimming pins; all that is required is that the lace should be correctly fitted and mitred in the first place, which a little practice will ensure. Where the door trimming is of pleated morocco, care should be taken to pare or scrape the back of morocco on outside folds, at the part that is going over the strips and under the lace, or it will cause a clumsy looking appearance, which would spoil the finish of the broad lace, as where every fold is met there are three thicknesses to deal with. The French trimmer in cases of this kind promptly uses a chisel, which he mostly carries for the purpose, and with it takes a piece out of the door lining; the same result can be produced by paring the morocco down a little. The inside of the lights are fitted with strips of ebony; this, if carefully done, gives a nice and very clean finish, without anything to fade or hold the dust. The broad lace used for door trimming had two tape edges. The doors are trimmed at the bench under a good light; a trimmer will certainly understand that a good light ought to produce good work. I was struck with the entire absence of floorcloth, most of the boots having a well bottom, the brackets being covered with patent leather welted, the bottom with plain indiarubber, with hole in centre to let the water run freely out; the part where the feet rest when driving had fluted rubber, this looked good and made a nice finish, very preferable to the showy floorcloth we so often see. The rubber was black and dull-faced; in some cases it was black harness leather, with a neat design creased on it. The contrast between the bright and dull surfaces added considerably to the lustre of the varnish and patent leather. This is a point that should be studied in choosing the materials for a carriage lining; for instance, if the materials should be satin or bright grained morocco the broad lace should be well covered with worsted, with a small silk pattern running through it; if the lining should be cloth or other full faced material the silk should predominate, care being taken that there are sufficient worsted to protect the silk pattern, otherwise it will not wear well. The French pay great attention to these matters, and are most exacting in the harmony of the colours

of the trimmings and painting. I saw nothing in the Exposition that was painful to the eye, only the lines of some of the bodies appeared to me to be cramped up, and they were also hung too low to be elegant, perhaps it was my English eye that could not take in their beauty; but this is a subject I must leave to experts in those particular branches.

The front seats had long box and driving ditto, trimmed in cloth and leather piping. Great care is taken in making the front seat falls; most of them had four rows of machine sewing for a border, and outside that were bound with patent leather to match piping. The seat rails were covered with patent horse hide, the whole were well matched and showed a fine finish.

Victorias in style of trimming were divided between the couch backs and the ordinary backs, with straight elbows and plain cloth quarters, with pocket and flap. None of the head linings had lace between roof and quarters, but were seamed through the centre of head. Most heads were three sticked and covered with cross grained cow hide, there were no straight joints, all had faint sweeps, and in covering botttom prop irons, a small flap is left to cover the prop nuts and protect the head leather from being cut or bruised by them when down.

In most cases there were two cushions to each seat; these I consider look very bad. The line is broken in the centre of the seat, for no good purpose that I could see, in fact, it would be very uncomfortable for a person to sit in the middle of seat as they would sit on seams and borders, which are stuffed much harder than the centre of a cushion.

I noticed also that in getting a straight elbow and long pocket across the quarters, they had set the pocket level and dropped the elbow in front. This to me looked very bad, the elbow should certainly be set level so that the two lines run parallel, or the elbow curved upward to meet the back. This is where a couch back has the advantage for a body with a deep back and shallow quarters.

I noticed one victoria only with automatic head without joints outside, the mechanical arrangement was not visible being trimmed, but it certainly seemed to work very well.

In only a very few cases was there a seat opening from the boot panel, the favourite method being to hinge the driving seat to top of bracket plates. The seat being lifted up showed a seat with a folding-up arrangement very similar to a folding step, which fell down on to boot panel. On visiting Messrs. Balvalette's factory, I noticed what I thought a better method (fig. 3) than having to lift driving seat; attached to inside of the boot were two iron slots fixed in a slanting direction from front to back of boot, across the front of boot was a spiral spring in tube, the seat was made with one fold similar to a folding step, the opposite ends of iron to the seat were fixed in the slots with studs and moved backwards and forwards so that being folded up and held up level with the slots it slid directly into its place.

Under the driving box the connection with seat and tube was by two pieces of webbing that rolled round the tube as the seat went into its place. The back edge of seat when down, filled up the space taken out of top of boot when it was in its place under driving seat. The slots were slanted so that in pulling the seat out it just cleared the bottom of seat valance, and when home nothing could be seen (see sketch).

A recess is left in boot panel in which is fixed a waterproof apron, neatly folded out of the way, and covered by a patent leather flap the full width of boot, and held down at the bottom by two turn buttons, the same as we use for the roll up back of a head. When the apron is in use it is held up in its place by two pins dropped into two sockets let into the elbow blocks, so that the sockets are flush with the trimming when the apron is not in use. This arrangement leaves nothing to catch a lady's dress, as a stud or hook would be liable to do. If it were necessary, there is room in the recess to fold a leather apron out of the way.

The interiors of their four-horse drags were trimmed with cow hide, imitation pigskin, the top parts were flat in panels stitched with white sewing, the roof of the same material had a neat design stitched in the centre; the bottom parts were mostly stuffed and quilted, although some were perfectly plain.

There was nothing either noteworthy in the landaus, the head mechanism was very clumsy, frequently without any connection of head joints and cant rail, and where this connection existed, eight separate springs were used where we use four, besides taking up a lot of room in body.

Most of the landaus were fitted with a frame hinged on to top of doors to carry glass frames independent of head pillars, and, when not in use, folded down inside of doors.

One of the best trimmed landaus was Kellner's. The material was green satin arranged as follows:—piped backs, diamond quarters, long pocket across bottom in front of edge plate, doors pleated in diamonds, four cushions with full tops not pleated, the work well finished.

All the heads lay a long way up at back, and low at elbows: In fact, I may say that there appeared to be but little attention paid to line of head when down; all were low in front and too high behind. Their head leathers were badly cut and carelessly fitted.

Seat borders, head valances, and head leathers are all machine sewn. The japan face of the leather used for covering wings and dashers, was as fine as a piece of plate glass, and the work so uniform in character that I felt very much interested, and determined to discover the reason for it. Upon visiting the various factories for which I had cards of introduction from your worthy president, I found the same quality of leather work.

By some of the workmen I was told that it was English leather, others said French, adding that it could be obtained in London as well as in Paris, and very kindly giving me a sample.

The uniform quality of workmanship was due to the fact that the wings, dashers, etc., were, with the leather, sent out by many Paris coachbuilders to one special factory. All were hand sewn, not machine stitched.

After a careful examination of the samples of leather, I found it is known in the trade as imperial hide, and is the same split of the hides made into what we term bag hide, but japanned on the grain or hair side, the part that is left smooth and brown in the bag hide. This leather should not be dearer than bag; but the result of this method of japanning is certainly superior to that obtained by japanning the flesh side of the hide. One great advantage is, that the grain not being so porous would not absorb so much japan, so there is not that quantity required to fill up the inequalities of surface that are met with on the flesh side; the more japan there is, the greater is the liability to crack, &c.

The grain side is level and firm to begin with, thus affording a fine surface at once, and being firm on the top it will certainly stand the sewing better, even with less care. Quick turns of iron-work could be covered with this leather without breaking the japan; in use, care should be taken not to roll it up with the japan inside, or it would certainly crease, although the creases would come out again to a certain extent, in straining on ironwork.

Messrs. Windover, London, were the only English firm with ironwork covered with this leather.

In examining the specimens, allowance should be made for their being cut from the belly or inferior part of the hide, as will be seen by the edge. French enamel head hide is, to all appearances, not so fine as ours, in fact, I may say they are out of it here. Moroccos are of various qualities, but the best are English finished.

In the French court is a very elaborate display of interior fittings, such as trays for fronts of single broughams, rings for door pulls, glass string slides, &c., made and finished in all kinds of materials such as ivory, ebony, horn, &c. Some of the cases were covered with morocco, satin, plush, silk, &c., in fact every kind of material that is likely to match the interior of any carriage. The

French have brought this department to a very high state of perfection, some of the trays are works of art of a very high order.

On visiting the factory of Messrs. Gall, I saw the fittings in their various stages of manufacture, also door handles, beading, all kinds of plate work, and a very simple arrangement for balancing the heavy front glass of a single brougham. It is less costly, but not so efficient as our method. They handed me two sheets of patterns which I forward with report. Their trays run from £1 to £4 each.

There was also a very fine display of carriage laces and all kinds of materials for trimming purposes; but such is the progress made by our English and Irish lace makers, that we who were formerly severely handicapped in this department, have little cause for complaint, as we are now able to obtain laces as fine as theirs at a lower price. The difference in some cases is as much as 1s. 6d. per yard in our favour; but in this branch they want careful watching, apparently they spare no expense in bringing everything to the highest perfection to please the eye.

There were several cases of leather for carriage building purposes, all very splendidly arranged and showing a very fine finish. All these things require careful attention by our auxiliary trades, as it is in the finish where the French excel. They have great natural advantages that we lack; the light and air seem clearer, their streets, avenues, and squares are much wider, and lined with trees that look in a very healthy condition; and a very magnificent display of works of art, meet the eye in every direction. They have also a good system of technical education assisted by the Government, all this must have a direct influence on the workmen, and also users of pleasure carriages; in fact, the eye is continually attracted by that which is pleasing to see. This, as it were, becomes grafted into the national character, hence the high and artistic finish that is given to almost everything they produce.

In visiting the various show rooms and factories, I was very cordially received, and in most places found an interpreter. They have, as a rule, splendid show rooms, some with marble lower floors, and polished floors upstairs, all well stocked with highly finished carriages, and appearing to be well looked after. All were spotlessly clean, and without a single pleat rubbed up or turned the wrong way.

Their workshops are very large and airy, with plenty of light and every convenience for the men to do good work. There are few of such places in our great city of London, and there are not many where a trimmer can have the body up to his bench. If rent in Paris is anything like it is in London they must be under a very heavy expense. In one shop as many as 260 men are employed, and here, I was informed, trade was good, owing to the quantity of work sent abroad, chiefly to America, the United States taking a quantity of work from Paris. There were several shops nearly up to the average of this one. They keep a good stock of timber, and are very proud of it.

There is a marked contrast between English and French workmen, the latter seemed slovenly in their dress and dirty in their work, and without energy and order. One could scarcely believe that the same men had produced the work in the Paris Exhibition.

Their bodies are trimmed previous to last coat of varnish. It was stated that four coats of English varnish and one coat of American varnish were applied to each body. The varnishing room in this case was heated by steam pipes, and was painted out twice a year. I was not allowed to enter and neither do I think anyone else was but the workmen. There were two workmen inside finishing the body and carriage, they were using flat brushes and had not a very bright light, not being a painter I wondered how they got so much varnish on without spoiling the colours; the floor appeared very dry, but had a quantity of varnish on it.

Upon going through the body maker's shops, I noticed that the roofs, in some cases, were covered with mole skin, others with leather pinned under the cornice at the front and on roof at extreme edges of quarters and back, and then pared off clean to the edge when dry. This system, it is said, stands in all climates.

I next visited the establishment of Mons. Dupont, carriage draughtsman, and was very cordially received there, and saw several students from different nations at work. The finished drawings were beautifully shaded, and had much labour bestowed on them. Six months is considered the usual term if the student has a previous knowledge of the trade. There were several different rooms with full-size drawings in each, also a room for patterns, and one with a bench, and tools for making them. I noticed that the board M. Dupont was at work at, had a horizontal bar hung across the front of board, and travelled in this position to any point where he wished to make a line, thus saving a lot of time, and by placing a square board on it, upright lines were drawn in a very quick manner. I never saw an arrangement like it before, but it must certainly save time where much drawing is done. In large factories in Paris, the trimmers as a rule work day work, with a foreman over the department. Very few work piece work, and most condemn the system, for when introduced it has generally lowered the standard of the work. The men admit that their work is not so elaborate as it was, and lay the cause of it to the system. Their piece work prices vary as much as they do in London; the following are a few given to me by the men: landau, 200 to 220 francs, single brougham, 130 francs, double brougham, 145 francs, victoria, 145 francs. Day wages run from 6½d. to 9d. per hour; the hours of labour are from 7 a.m. to 6 p.m., with an interval of one hour from 11 to 12 a.m., for what they call their lunch, no doubt, for they all seem to dine after 6 p.m. at the various cafes. Their food is served in small portions such as a little soup, then small portion of meat with bread, half a pint of wine, then vegetables such as cauliflowers with sauce or haricot beans served in the same way and then a little cheese. In no case did I see joints of meat and vegetable served up in the same way as we get them in England. I must say I saw no drunkenness, neither did I meet any teetotallers. Wages are paid fortnightly, in some cases monthly, at 6 p.m. on Saturdays. Some small shops work half day on Sunday, but this system is dying out.

The women lining makers work in same department as the men, and are paid at the rate of 5d. per hour.

The Parisian coachmakers have a separate trades union for each branch. I had a long conversation with the leading men of these societies, and found them fully alive to their troubles and the disadvantages to themselves of Sunday labour. They invited me to attend a meeting of workmen from various countries of Europe. All the delegates attending advocated the eight hours' system, the only difference between them being whether they would get it through their various Governments, or by international federation. I was certainly struck by the earnestness of those men, there was, as nearly as I could judge, 500 delegates there, and their expenses were paid from a fund of 50,000 francs that was voted by the Municipal Council of Paris to entertain the foreign delegates visiting the Exhibition.

Taking their rate of wages per hour, I should say that the French trimmer is better paid than the English for the amount of work produced. They do not get over the work in the time that the English trimmer would do, not that these men are any the less intelligent, but because their long hours of labour take out of them the energy and push they should have.

The officers invited me to attend the opening of the technical school which took place the same evening. I found the chairman for the evening was a member of the Municipal Council, supported by what I should take to be a master coachbuilder. I was taken to the front and introduced, and was asked to say a few words to the students, a wish with which I complied to the best of my ability. They seemed very pleased to find an English coachmaker amongst them. There were about 200 students present, the rooms being filled up with desks and forms. On the walls were several drawings, one very highly finished off, a victoria similar to that I had seen at Mons. Dupont's, several small prize drawings done by the students, and cases of models in iron and wood. In front of me laid several small drawings of different parts of carriages, doubtless work of younger students previous to making an attempt on a complete drawing.

The system of teaching seems very similar to that adopted here. I could not find that any branch had special practical lessons, although I made special enquiries on this point.

I gathered that the schools are conducted by members of the trades unions, that members went free and non-members paid two francs per month and attended four evenings a week. The Government pay expenses of building and gas, the other expenses are met by contribution and fees. There are several of these schools in Paris, they supplied me with a rule book, also one of the trades unions rule books, which I forward with report.

They have an excellent institution in Paris for settling all trade disputes. It is called, *Le Conseil des Prudhommes*, and is composed of eighty members elected every three years, half workmen (no foremen) and half employers. They are divided in four sections to suit all trades most nearly allied to them. Whenever a dispute occurs the person aggrieved summons the other before the Court of Conciliation consisting of seven members, the office of President being occupied alternately by an employer or workmen. If the decision is not acceptable either party may appeal. The case then goes before the Chamber of Commerce or Court of Arbitration, the President of which is a paid legal official.

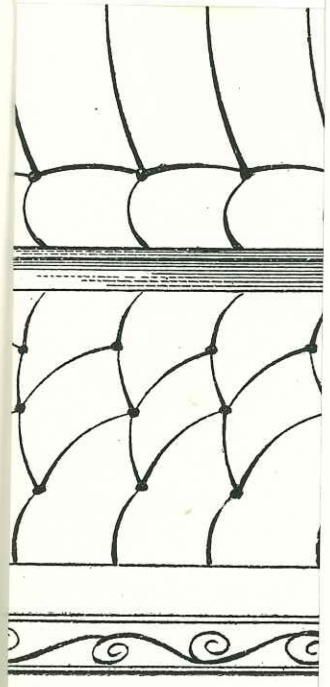
The first court costs three francs to enter, but as the Appeal Court expenses are very heavy it is seldom resorted to. The Municipal Council vote 12,000 francs per year for councillors of the first court, but the employers very seldom accept any expenses out of this fund, although both parties elected to sit are entitled to be paid for services rendered. This Court has no power to deal with a body of men seeking a rise of wages or a reduction of hours.

Shortly after the last French exhibition, our trade was very dull owing solely to the general depression of trade in the country, and simply because the French had made a change in the style of their trimming, a cry was very soon raised that we were beaten, and that we did not know anything about coachbuilding or trimming. A greater mistake could not have been made, the system of pleated work was as well known here as there, but the difficulty the trimmer and, in some cases, the coachbuilder had, was to educate his customers to a more artistic style of interior, and that difficulty is ofttimes met with now. Our carriage users are very conservative, especially about the interior, in some cases, I may say it is a crime to make any change. Our best work is equal, and in some cases, far superior to anything the French have in the Exhibition, and no doubt that is the best. In general construction and design they are a very long way behind us.

The evil of our self-depreciation is that it does *not* end here, it is copied from our trade journal, into the French, and they at once make capital of it by sending it to the American journals ; hence the prevailing taste and demand for French work in America.

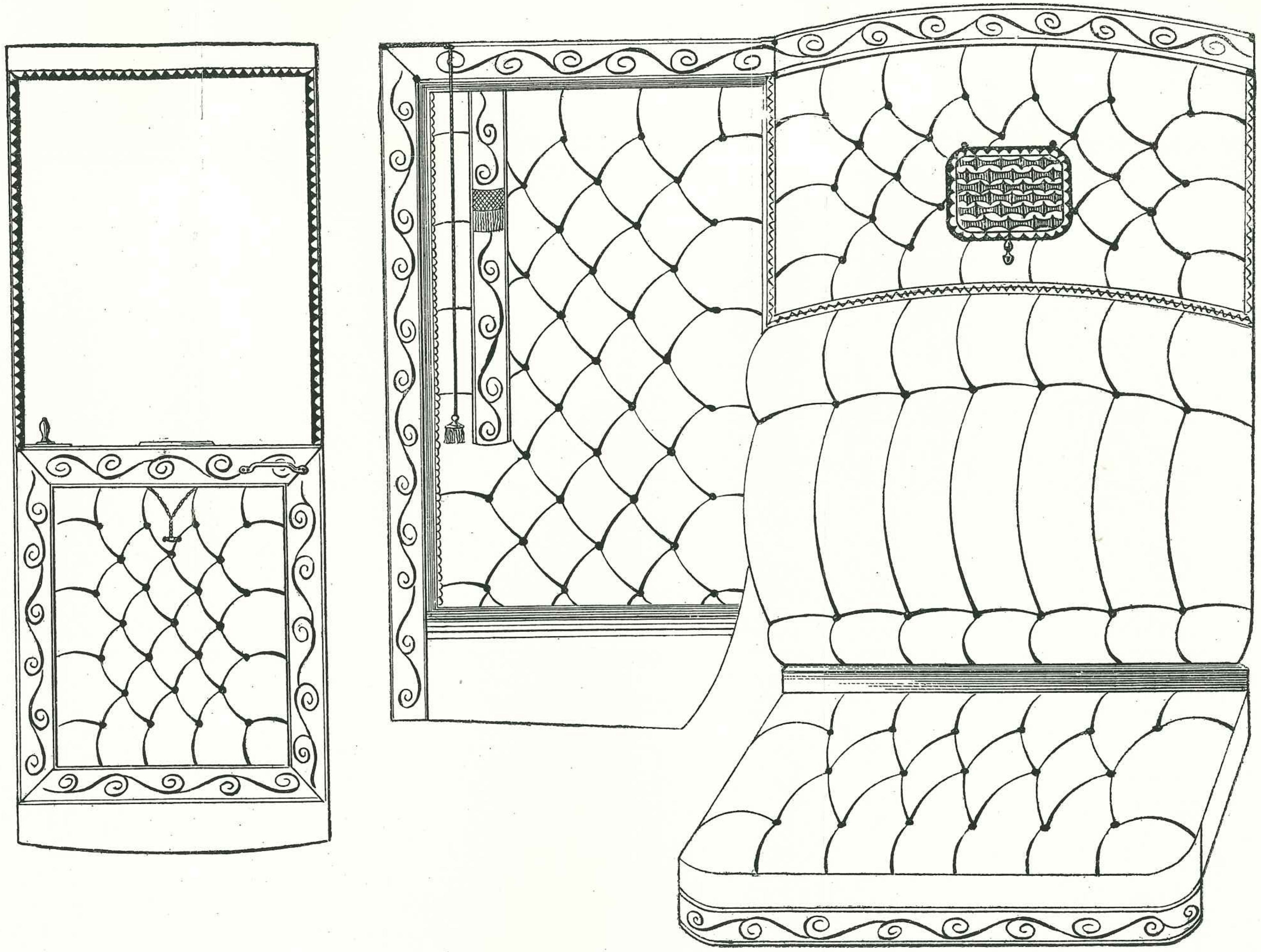
In conclusion, I beg to tender my warmest thanks to your President for the assistance he rendered me in obtaining admission to the various factories, also to all gentlemen who interested themselves on my behalf. I trust that my efforts may be of a little assistance to our young trimmers, by bringing this branch of our trade to a higher state of perfection, so that we may maintain that proud position which we have always held as the constructors of the most durable and artistic carriages that the world produces.

EDWARD EVANS.



NG.

Fig. 1



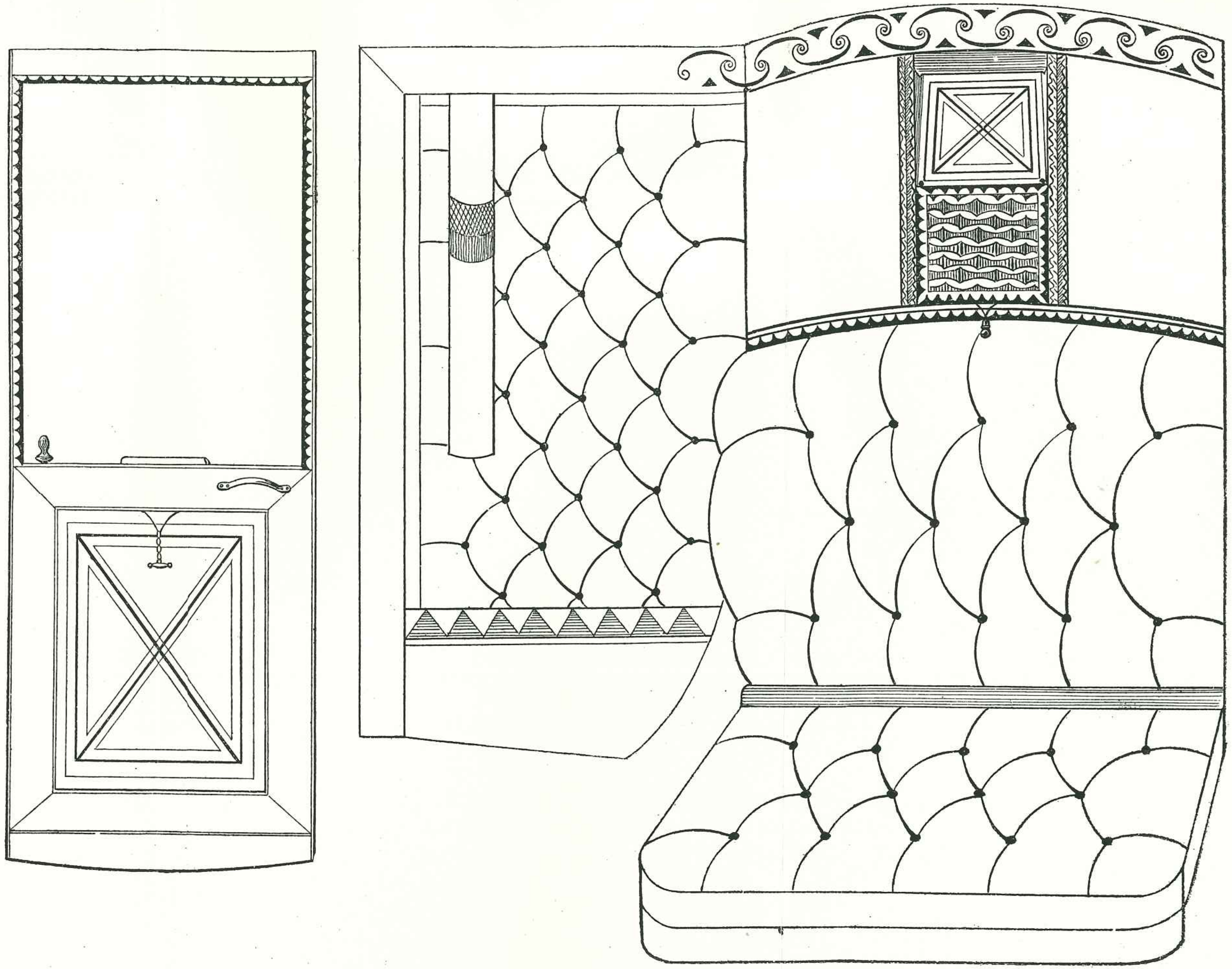
Lithographed by John Kemp & Co.

ARTIZANS' REPORT ON CARRIAGE TRIMMING.

As shown at the Paris Exhibition, 1889.

SHEET 1.

Fig. 2.



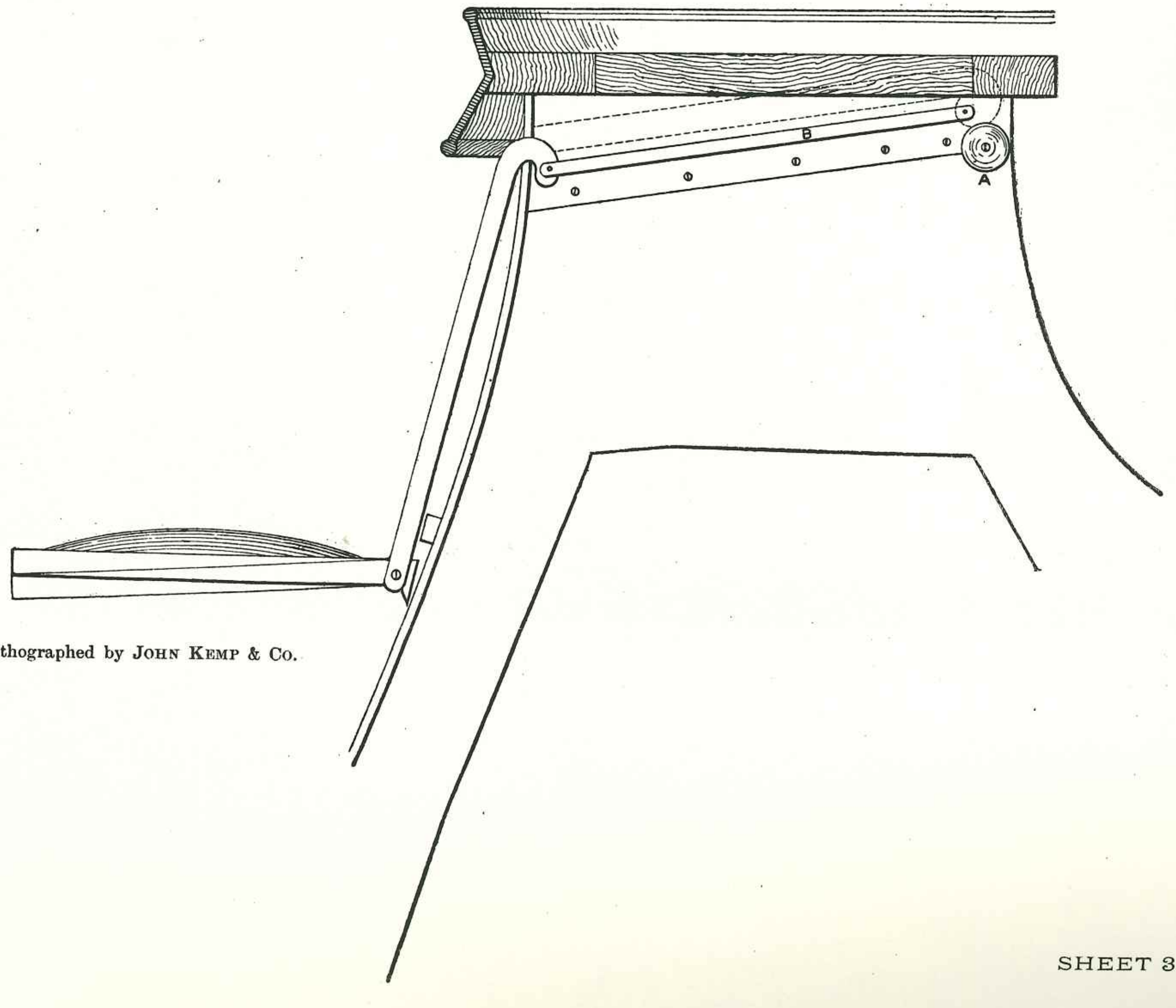
Lithographed by John Kemp & Co.

ARTIZANS' REPORT ON CARRIAGE TRIMMING.

As shown at the Paris Exhibition, 1889.

SHEET 2.

Fig. 3.



Lithographed by JOHN KEMP & Co.

SHEET 3.

ARTIZANS' REPORT ON CARRIAGE TRIMMING.
As shown at the Paris Exhibition, 1889.

A DESCRIPTION
OF
SPRINGS AND AXLES,
BY
JOHN PHILIPSON.
(FROM INFORMATION SUPPLIED BY A FRENCH EXPERT.)

SPRINGS.

THE majority of the builders whose productions figured at the Exhibition have shown very great care in the proportions, and the construction of their springs.

The conditions of suspension, the distribution of the weight, the comfort of passengers, and the permanency of all the parts have been minutely studied.

In the different sections, French and foreign, there were a great variety of forms, but those which are the most generally employed, and which appear to be the most rational, are the following, and their different varieties :—

Elliptic springs with various modifications, of which we hereafter give the most important details.

Half elliptic and cross springs; sometimes called "side and cross springs."

Eight spring carriages have the ordinary cee-springs with dumb irons and straight side springs.

In the English section several coachbuilders exhibited carriages with cee-springs of one particular form.

The spring forming a combination of cee and elliptic represented on the sketch No. 6, is the one adopted by Messrs. Morgan, Windover, McMullen, &c.

The principal purpose of a cee-spring is to relieve not only vertical but also longitudinal shocks, whereas the spring shown by fig. 6 is simply an ordinary elliptic; it is very high in price, and its power of resisting wear and tear and strains, appears doubtful.

In general, the practice of the good builders is to make the springs as long as the method of suspension will permit. Springs are made with a strong back-plate, and several thinner plates, or leaves, the number and length depending on the weight to be carried. On the back-plate are forged the eyes or heads which must be sufficiently strong to withstand the effects of draught, and the various shocks occurring during the motion of the carriage. The other plates are well drawn, and the tapers proportioned, so as to give a regular flexion along the length of the spring; in short, the ends of the leaves are nearly always worked to a point, either with or without chamfers.

The next sketch indicates the shapes of plate-ends most usually employed. The exhibition table of Messrs. Lemoine contains the most of these forms, and the various examples of eyes or heads.

We have summarised below the various types adopted by the principal builders of carriages figuring at the Exhibition:—

M. Bail, Jun., Paris.—Method of mounting, elliptic and half elliptic; kind of eyes, English, No. 7; ends of leaves, No. 4A.

M. Binder, aîné, Paris.—Method of mounting, elliptic and half elliptic with cross spring; kind of eyes, English, No. 12; ends of leaves, No. 4A.

M M. Binder Frères, Paris.—Method of mounting, elliptic and elliptic with cross springs; kind of eyes, English, No. 12; ends of leaves, No. 4. The leaves are drawn very much apart, and the ends are very slender.

M. Henri Binder, Paris.—Mounting, elliptic and half elliptic with cross springs; eyes, English, No. 12; ends of leaves, No. 2A.

M. Belvallette, Paris.—Mounting, elliptic and half elliptic with cross springs; eyes, English, No. 8; ends of leaves, Nos. 2 and 3A. The spring eyes and the heads of the bolts are chamfered as indicated on fig. 8.

M. Grümmer, Paris.—Mounting, elliptic and half elliptic with cross springs; eyes, English, No. 12; ends of leaves, No. 3. The plates are well drawn, but their thickness at the extremity is ordinary.

M. Healey, New York.—Mounting, elliptic and half elliptic; eyes, English, No. 12; ends of leaves, Nos. 3 and 3A.

M. Jeantau, Paris.—Mounting, elliptic and half elliptic; eyes, open eyes, No. 10; ends of leaves, No. 1.

M. Kellner, Paris.—Mounting, elliptic and half elliptic; eyes, English, No. 12; ends of leaves, No. 3.

M. Morgan, London.—Mounting, springs, No. 6; open eyes, No. 10; ends of leaves, No. 3. This form of springs is not merely adopted for the two-wheeled carriages, as is sometimes the case in France, but also for the front and back of four-wheeled carriages.

M M. Million, Guiet, & Co., Paris.—Mounting, elliptic and half elliptic; eyes, English, No. 12; ends of leaves, Nos. 3A and 3. The form of the ends of the leaves differ from the form No. 3A, in that the end is very convex, and merely thinner on the sides.

M. Mühlbacher, Paris.—Mounting, elliptic and half elliptic; eyes, No. 9; ends of leaves, No. 3. The eyes are particularly remarkable. The bolt is furnished with a brass bobbin in two parts, so that the friction of the bolt and the eyes is made on the brass surfaces. This gives excellent results, and totally prevents the squeaking of the ends, so frequent and so disagreeable a defect.

M. Rose, Paris.—Mounting, elliptic and half elliptic; eyes, English, No. 12, but with very large eyes for leaving considerable play between the bolt and the bottom of the end; ends of leaves, Nos. 2 and 1A.

M. Kolber Brüler, Buda-Pesth.—Mounting, elliptic and half elliptic; eyes, English, No. 12; ends of leaves, No. 3.

M. Rothschild, Paris.—Form of mounting, elliptic and half elliptic; form of connections, open eyes, No. 7; form of ends of leaves, No. 1B. The bolts for the eyes are furnished with india-rubber tubes and brass ferrules. The object of this improvement is the reduction of the vibrations caused by rolling, and of having the friction between the bolt and the eye as little as possible.

M. de Rüytter, Brussels.—Mounting, elliptic and half elliptic; eyes, open eyes, No. 7, but without the india-rubber and brass ferrules; ends of leaves, No. 3. For certain mountings, the half elliptics have spoon ends (fig. 5 and 5A), and are fitted with what are in England termed "cow-mouthed" shackles—sketch No. 13.

M. Windover, Paris.—Mounting, springs No. 3. These springs have the nearest resemblance to those of Messrs. Morgan, which we have spoken of before.

AXLES.

THE majority of the axles on which the pleasure carriages are suspended are of the Collinge system with patent oil boxes. The front axles are straight, while those of the hind-carriage are generally cranked.

The cranked axles have the advantage of permitting the body being hung low, while preserving a sufficiently great diameter of wheel.

The form of the cranks is rather variable. They differ according to the taste of the coachbuilder.

The exhibition of M. Lemoine contained all the types of cranked axles seen under the different carriages.

The cranked axle having a shoulder of standard form is met oftenest under the coupés, mylords, and landaus, and is that represented by sketches 14, 15, and 16, and in the carriages shown by MM. Rothschild, Muhlbacher, Million, Guiet, & Co., &c.

There is a remarkable degree of perfection attained in the forging of these cranked axles, permitting us to reduce as much as we may desire the distance between the spring and the collar which is important (see sketches Nos. 15 and 17) for the strength of the axle.

This disposition has the advantage of permitting the greatest width of body for a given track, or the smallest track for a given width of body. In that case the crank, the flap, and the collar of each of the ends of the axle should be raised from the solid iron.

We observed an axle of that form (fig. 17) under the two-wheeled carriage exhibited by M. Gosset, carriage manufacturer, Sevres (Seine).

The other types of cranked axles are those of Messrs. Mühlbacher (No. 18) used on a mylord; those of M. J. Binder, No. 19; and those of M. Henri Binder, No. 20.

In the collection of axles shown, some are remarkable as examples of forgings.

Amongst the omnibus axles there is a type of cranked axle (No. 21), which has the advantage of permitting the vertical motion of the body without coming into contact with the crank or the angle, a point of great importance.

The double cranked axle of 2½ inches diameter for omnibuses of the public service is a piece of remarkable forging (fig. 22); the collars are sunk in the cranks, and each part of the axle is of one piece—crank, flap, and collar.

The cranked axle (fig. 23) for special service omnibuses has a particular arrangement of the flap, which is above the arm, thus permitting the mounting of the springs outside. This axle is used on the omnibuses belonging to the "Journal la France."

The double crank axle (No. 24) is a pretty model for a "duc de dame."

No. 25 is a cranked axle with a square flap on the shoulder, carried out in the solid iron, and is an interesting example of forging.

The double crank axles (Nos. 26, 27, and 28) are used in hanging family omnibuses.

In the catalogue of M. Lemoine there is a double crank axle with flaps on the square, and arms and collars above (fig. 29), which combines all the difficulties presented in the forging of an axle. This axle was exhibited with this view alone, in other respects, it was merely a rough forging.

Many of the coach-builders, those of Paris, in particular, furnished their axles with very large caps, the faces of which permitted the builders to engrave their names in bold letters, they also formed a large reservoir for the oil, which is an excellent thing.

M. Mühlbacher has adopted for his axles, collars of great diameter, which necessitate an increase in the size of the axle boxes, thus the holes in the naves are increased in proportion to the collars, but it is an incontestable advantage to have large washers, because the loss of oil is to be guarded against, and it is better to have a voluminous oil reservoir.

The English coachbuilders have always used large axle boxes.

Great progress is visible in the manufacture of axles, and the general use of wrought iron boxes. A great number of the axles exhibited are fitted with W. I. boxes, those of M. Lemoine in particular.

The manufacturers of axles are now producing their boxes at a price so little in excess of that of cast iron boxes, that the general employment of the former is assured.

The advantages of W. I. boxes are briefly as follows :—

The W. I. box is lighter than that of C. I.

The exterior diameter of the box is obviously smaller, and necessitates a smaller hole, so that we may have a nave that will better withstand the effects of wear and tear.

The W. I. box offers another considerable advantage, as a nave of smaller diameter may be used, the durability of the frictional surface is greater and not so easily worn, as the frictional surface is perfectly smooth.

There is no risk in driving a box of wrought iron, whereas one of cast iron may be fractured during the operation and the rupture be imperceptible.

Finally the box being thin, the size of the oil reservoir is increased in proportion.

In the course of a visit to the works of M. Lemoine, the following information was gathered, and we reproduce it here in the interests of the Institute.

NOTES ON THE MANUFACTURE OF AXLES AND SPRINGS.

Axles.

The manufacture of axles and springs, so simple at first sight, is complex, and the outcome of a long development.

We will confine ourselves here to general considerations, and only speak of those carriage axles and springs, to the manufacture of which practice and experience are devoted.

In this order we propose to deal with the subject :—

1. The choice of the metal employed.

2. The care it is indispensable to bestow upon the working of that material.

The axle properly said to be of iron.

Considering that axles must have sufficient resistance to bending arising from the weight of the vehicle, and the action of the wheels against obstacles, and that they must possess sufficient elasticity to resist change of form under the influence of those combined forces, and the accidental shocks to which they are constantly exposed, we must conclude that iron is the best material for axles, iron soft and fibrous ; where the iron is granular or short, of good quality, which the forging renders fibrous.

One frequent cause of the breaking of axles is the tendency of iron to crystallization, under the influence of continual shocks and vibrations.

A transformation in the molecular state of the iron may be, and is, produced, when the sections of the different parts of the body submitted to those exterior actions, are not sufficient for maintaining the efforts to the limit of elasticity, this is more particularly the case with railway carriage axles, when the successive vibrations take place at too short an interval for allowing the molecules to return each time to their primitive position of equilibrium, as they would at the end of a convenient repose, they thus deviate more and more at the end of each oscillation.

Without exaggerating the phenomenon of the tendency of iron to crystallize, we ought nevertheless to possess calculations of a general character and principle as to its effects on light axles, to be used running rapidly on the streets.

The Omnibus Company of Paris exhibited a series of broken axles illustrating the different stages of crystallization. Each axle was marked with the distance it had run.

In the manufacture of axles, steel presents great advantages from an economical point of view, especially in allowing us to diminish the size of the arms without loss of strength, and rendering very easy the hardening of the arm, but considering the influences which we need not refer to, and to which the axles are subject while in service, we are absolutely opposed not merely to the employment of steel, but to the employment of iron of a steely nature.

The quality of the iron is the principal consideration in an axle.

The method which presents the most reliable results, is to submit a sample of the iron to a direct tensile test, which is followed by rupture. This is the most effective test, and has the advantage, under the same conditions, of always rendering comparatively perfect results, which are not dependent either on the ability or the partiality of the assayer.

It gives a knowledge of the breaking load, and of the elongation to which the iron may be considered susceptible.

Elongation is a capital test for iron for axles, and it is an important one in calculating its value. As the result of numerous trials we have classed amongst the most suitable qualities of iron those which give an elongation of 28 or 29 per cent. as a breaking load, corresponding to 77 or 79 lbs. per square millimetre of the original section, a good test.

For confirmations of the results thus obtained we may apply the tests to the same iron, both hot and cold. This mode always give useful and conclusive results, and prevents error.

For example, a sulphurous iron may present, when cold, all the necessary qualities for axles, but it would be impossible for it to undergo a good hot test, whereas a phosphoric iron is easily distorted and will not bear cold, in a word, it should be perfectly understood that it is improper to use in the manufacture of axles iron containing phosphorus which renders it brittle.

It is impossible to calcutate the strength of an axle, experience and observation have led to the adoption of the different dimensions.

If an axle had not to resist any other strain than that which comes upon it in repose, the determination of its shape or dimensions would be easy, but the strains to which it is accidentally subjected while travelling, the vibrations, the incessant shocks owing to the inequalities of the road, make it impossible to determine in any other way than approximately the dimensions to be given to the different parts of an axle.

Nevertheless we may take into account the exceptional circumstances in considerably reducing the co-efficient of resistance of the iron. It is not advisable, for example, to load an axle more than 5lbs. per square millimetre. Another element it is necessary to take into account is the length of the arm of the axle ; it is important not to exceed a pressure of 39 to 41 lbs. per square centimetre, taking for our calculation that the contact between the box and the arm is equal to the projection of cylindrical surface of the latter on the plan of the middle.

Based on the dimensions adopted in practice for carriages to carry passengers, and for complete security, we have an empiric formula established giving in kilos. the maximum weight which the axle arm may carry :—

P. = The weight required.

d. = The diameter of the arm.
l. = The length of that portion of the box resting on the arm.

We have $P = \frac{d^3}{l}$

To find the weight which the axle may carry we must double the value found for P.

FORGING OF AXLES.

The forging of axles may be divided into five classes :—

1. Straight axles without flaps.
2. ,, ,, with flaps.
3. Cranked axles of various forms without flaps.
4. ,, ,, with flaps.
5. Axles with collars made out of the solid iron.

The fifth class comprise all the various forms included in the four preceding classes.

The forging of straight axles without flaps is very simple, and does not present any difficulty, those axles are always made from a single piece.

The straight axles with flaps are generally made in two ends; the only difficulty which occurs in their forging consists in the necessity for the flaps being intimately forged with the body.

The chief method employed by a great number of makers, because there is no necessity for any special tools, and very little waste, consists of welding the flaps to size, or in drawing them (figs. 33 and 34).

This method is not acceptable because it is often difficult to weld the flaps perfectly. In fact, especially when the axle is of a certain strength, the fibres of the collar and those of the axle are crossed, and have consequently little sympathy one for the other. The chief inconvenience is, therefore, the risk of an imperfect weld, and the results of a bad weld are the failure of the collar and the chance of rupture of the axle.

Few of the flaps are perfectly welded in the angle A., fig. 34, as it is easy to find on examining the axle of a carriage which has run a certain time, as very often the scarfing of the axle is broken at the junction, which proves that the collar has been displaced from the body of the axle under the influence of shocks and vibrations. Or, if it is found that the section of an axle is diminished at that point by $\frac{1}{5}$, $\frac{1}{4}$. or $\frac{1}{3}$, it is done by the change of section and the sharp angles which produce the rupture.

Another disadvantage, or an advantage from the point of view of the consumer and producer, is that the manufacture of axles with welded collars is compatible with the employment of iron of an inferior quality, and of a section almost equal to the size which it is desired to obtain.

The result is that the arms will not permit of sufficient heating and working without showing flaws. In that case the arm may have an interior cavity, like that presented by fig. 35 in which case the iron swells with the least increase of temperature, due to the friction, and grinding is sure to result.

It is not without some interest to consider that with the welded flaps we meet a certain difficulty, when it is a question of repairing the arms of an axle in which the distance between the flap and the collar is little or nothing. The drawing often spoils it, and the flaps come off.

We call repairing an arm, the operation which consists of giving an arm admittedly defective, either at a stage of the manufacture or after a certain length of service, and joining to it, by way of welding, a new piece of iron to restore it to the former condition, to render the whole capable of further work.

A second method employed for the making of flaps, and which is much preferable to the preceding one, is that which consists in forging the flaps in the solid of the axle, this method is called "raising in the solid."

Fig. 36 indicates the several operations necessary.

The square iron is heated in the furnace. The arm and the body are roughly formed, and we thus save the piece of iron necessary to produce the flap, the first form is returned to the furnace and brought to a welding heat, and afterwards forged.

It is absolutely necessary that the matrice should be closed by one operation; if the arrangement of the machine is such that several blows are necessary, the weld of the collar is imperfect, and further the weld which is formed by the second or third blow, is very slight and cools rapidly, and is thus quickly destroyed. On the contrary, if the hammer is of sufficient power and the iron sufficiently heated to produce a real running of the iron, the flaps may be bent with impunity. Especially so, if the iron employed is fibrous and of good quality, and the joint is well formed so that the angles are properly rounded, and that there is no interruption of the fibres from one end to the other of the axle, and the thickened parts are made with a proper regard to the flap.

The direction given to the fibres during forging make the following processes easier :—

Instead of employing a homogeneous mass of iron, we use a rough form, like No. 2, fig. 36, formed by a number of leaves (faggotted) of thin plate, imperfectly welded, which we present to the hammer in the vertical direction of the leaves. After the hammering we easily ascertain the direction of the fibres, as indicated by fig. 37.

It is evident that a mass of fibrous iron, if allowed the same workmanship, may be compared to that constituted by a series of infinitely thin layers.

The advantages and guarantees presented by the manufacture of axles and flaps out of the mass are :—

1. The obligation of employing an iron of sufficiently good quality.

2. The strong section of the iron necessarily employed subsequently renders the body and the arm very fibrous.

3. The hammering, which necessitates the strong section, has the advantage during the heats of expelling all the impurities from the iron, and rendering it more dense ; consequently the turned arm presents no trace of flaws or dirt, and, at the same time, is more durable in use, and less sensible to the deformations due to the influence of case-hardening.

4. The flaps are square, that is to say, have their edges perpendicular to the body of the axle.

When the section of the body of the axle and flap attain a certain strength, we avoid as much as possible the welding of the middle, and make the axle in a single piece ; we thus prevent any chance of a bad weld, and we also avoid any difficulty about the junction of the two ends of an axle of rectangular section, and in the precise length of the two arms ; the axle of one piece is much better, very straight, and it is extremely easy to regulate the arms.

The cranked axles without flaps are very often made with cranked centres ; their forging is simple, but it is necessary to take certain precautions in the making of the cranks. We must take care in commencing the bending of the arch never to drive the iron so as to produce the heel "a" (fig. 38). Its presence is indispensable, but in thinning the bend, we give to that part the necessary strength. It would be better to take iron of sufficient size, which, when reduced, would give the heel in question.

The form of cranked axles with flaps varies infinitely, but we shall be content with studying one of the forms mostly used—that of cranked axles with shoulders. The cranks and the flaps are made in the mass. Fig. 39 represents the successive operations in their forging. The axles thus made are of one undoubted quality. Fig. 40 indicates a second way of forging this kind of axle. It is sufficient to take a piece of iron, which constitutes the body of the axle, on which we weld the flaps, and afterwards weld into that another piece, which forms the bend on the arm. This process is old, does not necessitate any particular tool ; it is rapid, inexpensive, but it is absolutely bad.

The method indicated by fig. 41 is not bad, but is dependent upon being well worked in the mass.

A form of axle, the forging of which presents a certain interest, and which, perhaps, gives a remarkable example of the process, is that represented by fig. 43. In it all the different phases of the manufacture are taken into account ; all the parts of the axle and the fibres of the iron are rational.

That axle with flaps on the top of the bend has the advantage of bringing together the wheels, and, in this way, reducing the track.

We may return to the axles with double cranks (fig. 43), which are formed by one operation, after having been conveniently prepared. These axles permit of the hanging of the body near the ground, while preserving a desirable height of wheel, and have equally the advantage of reducing the length of the track. They are generally employed for small omnibuses.

We substitute to-day the welded collars by the raised collars, which present in a high degree all the advantages of the welded collars, without their objections. The welded collars give excellent results, if perfectly welded, but their adjustment is the difficulty, and a badly-welded collar may mean the rupture of the axle. To obtain a soundly-welded collar is difficult to any smith, except he be a good and conscientious workman. It may also occur that the iron of the collar may not be of the same nature as the iron of the axle, otherwise the fibres of the iron of the collar, and those of the axle, may be crossed ; the weld is difficult, and the collar may cut the axle. In this case, if the weld is not perfect, the axle, which is so much fatigued, will undoubtedly break.

The raised collars present, in a very high degree, all the advantages of the welded collars, without their inconveniences. They allow (1st) of considerably reducing the strength of the body of the axle, the collar not having so much need of support, as in the case of the made collars ; (2nd) the failure of the collars, which very often creates great annoyance, is avoided ; (3rd) there is less chance of waste of oil.

The advantage which the welded collars present in permitting the employment of a light body up to behind the collar is valuable in the case of private or other light carriages.

The figs. 44 and 45 sufficiently indicate, without which it is necessary of explanation, the different phases of transformation to which the iron is subject in the manufacture of ordinary straight axles, and those with cranked beds, a shoulder with flaps and collars raised from the mass of iron. We observe that this method necessitates the iron being conveniently squared, equal to the height comprised between the lines a, b, c, d of the axles to obtain.

TURNING OF AXLES.

The work of turning axles may be divided into four very distinct categories :—

1. Patent oil axles (Collinge's system).
2. Ordinary patent grease axles.
3. Patent grease axles.
4. Half patent axles.

The patent axle with oil box, was invented by an Englishman, John Collinge, in 1787. Numerous makers have since tried to make several modifications to the axle invented by Collinge, but their innovations have been unfortunate, and the results which they have given are but mediocre, and we have never abandoned the axle which that inventor conceived. It is, therefore, the Collinge axle which, by reason of its numerous applications, merits the most attention.

Owing to the great care necessary in the manufacture of a patent oil axle, it is certainly one of the most difficult pieces of mechanism to obtain in perfection ; it has to be mounted and maintained with the greatest care, to prevent those accidents and derangements caused by sudden shocks, jars, and vibrations, which lead to rupture.

Turning to the view of an arm and collar (fig. 27), the frictional part of the arm must be perfectly cylindrical. One of the principal reasons for this is, that the box always occupies different positions of bearing on the arm, according to the wear of the washers, consequently if the arm were conical, the noise and rattling would be fatal.

In turning the arm, it is necessary to observe the tapers of the different parts. These tapers should be of the greatest possible radius ; in general, we would take every care to avoid sharp angles and pronounced differences of diameter ; it is nearly always at the sharp angles that an axle breaks. Another constant cause of fracture is the absence of a sufficiency of taper to the right side when the swell succeeds to the body. It is equally necessary to pay attention to this point when it is concealed by the iron collars, and its good workmanship is dependent on the conscience of the axle turner. Thus, the collar ought to be in proportion to the arm.

For the same reason the screwed end should be in proportion to the arm, and in the profile we should avoid sharp angles. The grooves which precede the thread should be properly rounded to the bottom, and not be deeper than the threads ; if we neglect this precaution, we risk the failure of the screwed end.

The swelling to a diameter of about $\frac{3}{16}$in. greater than the diameter of the arm, will admit of a small groove from $\frac{1}{16}$in. to $\frac{3}{32}$in.

deep, as a receptacle for the oil, preventing it working as far as the leather washer when moving in the reservoir.

The utility of the swelling is evident ; it supports all the load and brings nearer to an equal resistance the arm and the body of the axle.

The place of the collet ought to be perfectly cylindrical, and of a diameter equal to the tool which has served to form the latter, and should be fitted very accurately, that is to say, without play, and without making it necessary to have recourse to the scraper for its adjustment.

The right and left hand screws should be equal cylinders ; the threads of full calibre and perfectly clean and round, so that it shall not be necessary to force the threads to correspond with the nuts, which are generally of brass.

The iron collar ought to have its face properly perpendicular to the arm, and have a recess to receive the end of the box. It sometimes has a conical interior so that the box may not touch (see m.n, m.n, fig. 28), when the leather washer is reduced in thickness.

The collets and nuts of patent axles are generally of brass ; that metal is exceedingly malleable, tending to counteract the vibrations and incessant little shocks to which it is submitted, and it lessens to a certain extent the noise which some carriages make in rolling ; it is also sometimes a cause of accident.

To obviate any inconvenience, we take away a great portion of the brass nuts ; this operation reduces the pores of the metal and renders it more dense, giving greater resistance to friction.

The collets and the nuts should be easily adjusted ; these pieces being destined to take in use a certain amount of play, it is necessary that they should not project.

As the nuts are to be firmly secured without the least play, the collars in particular demand to be made with the greatest attention ; it is necessary that the drilling tool have a diameter rigorously equal to that of the corresponding part of the arm, and that the flat side P coincides exactly with its position.

The collet ought to be turned perfectly round, and the inclination of the surface of the cone ought to be the same as the corresponding surface of the box.

In the manufacture of a new axle it is diminished equal to the thickness of the leather washer (e fig. 27) ; it is important not to reduce too much the length of the ring to the detriment of its stability, and equally so not to employ washers of too great a thickness.

The caps are generally made of brass ; the reservoir R (fig. 27) should be as large as possible, and ought to be evenly turned.

When the strength of the arm attains a certain importance, for example, in the case of omnibuses and trade vans, we replace with advantage the brass nuts with those of iron.

We frequently employ only one nut (fig. 29); that form of nut has the inconvenience of not allowing a tightening of more than ⅓ of the length, consequently the play results in the loss of oil, and in noise. It is not without interest to remark the continuance of the longitudinal play, of the incessant shocks of the box against the collet, which are transmitted to the nut, so that at the end of a certain time the threads do not correspond to the tapping of the arm. It is difficult to practice in a nut of more than six cuts, and the system is not applicable to pleasure carriages.

The iron collet, hardened and tempered, substituted for that of brass, gives excellent results, but its price is relatively high, and prevents its more frequent employment.

There exist several other systems of nuts, but the results which they have given are unsatisfactory in practice.

We may, however, refer to the arrangement represented by fig. 30, which is often employed. We understand that when the right nut tends to slacken and consequently to advance, it brings into its movement the left hand nut which moves to meet it. We should be careful in splitting the male cone, so that it may be a veritable grip with which to tighten as much as the right nut tends to loosen.

The inconvenience which may be said to belong to this system, is the tendency of the left screw to force an excessive length, and particular care must be used to avoid a rupture.

The type of patent axle box is that represented by fig. 27; the box is the principal piece of the system, and demands the greatest attention and care.

The delicacy of the work rests in the fact, that the box of a patent axle has three very distinct frictional surfaces.

1. The back of the box, p.p., rubbing on the collar.
2. The cylindrical surface, which ought to be in perfect contact with the corresponding face of the arm.
3. The conical surface, b.c., which rubs on the collet.

If the face, p.p., is not exactly perpendicular to the axis, x.y, of the cylinder, and if the axis, o.x, and the conical part does not correspond to the axis of the cylinder, the friction caused by the rotation will not be the same on all portions of the surfaces, the result is noise at first, after which the axle fires and sets stiff. It is certain that the majority of accidents are due to a fault in the manufacture.

The difficulty of correctly turning these different frictional surfaces, should be easily overcome, if the box, after leaving the hands of the turner, is fitted on to the arm before it is case hardened, and all precautions are taken to find any deformities created by the case hardening; there is, thus, the opportunity of minutely rectifying any surface defects which may leave corresponding marks on the arm.

The boxes of patent axles are made in cast iron, wrought iron, and brass.

Cast iron boxes generally employed present grave inconveniences, the operation of case hardening has the effect of rendering the boxes fragile, notwithstanding the quality of the cast iron employed, and the care we take to toughen the interior. It should be easy to obtain the boxes less brittle and the tempering softer; but we do not ignore that a durable interior is an essential quality which ought not to be sacrificed on any account; to many manufacturers, this sacrifice is a cause of rejection and much expense.

The desirability of obtaining the boxes less fragile has led to the trial of natural tempering on the metallic mandril, known as chilled casting, but, although that process presents great advantages from an economical point of view (supplanting the boring and the inconvenience of water tempering), it never gives results sufficiently good. One of the very great difficulties is to give the wearing part a regular and constant thickness, if that part is very thick it is easily understood that the box will also be brittle, and moreover, with the tempered box for ordinary naves, we seldom or never obtain for the tempered part, perfect durability.

The general application of these boxes is not convenient, and they are generally used for axles of an inferior quality, of which many are defective.

The wrought iron box does not present these difficulties, and should be susceptible of a perfect temper. A little higher price is given for it, as it possesses so many desirable qualities, and in time it will be solely employed for the axles of carriages.

The hardness of the frictional surface is better and finer, and, to speak generally, the result is that the box has an unlimited and perfect smoothness.

A brass axle box gives a smooth frictional surface, and completely eliminates the chance of skidding, the last advantage is one often preferred to the box of C.I. used for carriages performing long journeys, as it is not easily distressed.

Unfortunately brass is rapidly worn, and at the end of a short time the axles make a noise.

It is to this fact, that the metal is impracticable for the boxes of pleasure carriages, properly so-called.

The patent axle presents, above the other systems, the great advantages of cleanliness, easy repair, and fewer inconveniences. Its construction does not permit, in effect, the constant use of the collet to counterbalance the thinning of the washers, which, after a certain length of service, inevitably allow play in the direction of the length. In tightening the two nuts for relieving that play, the left hand nut is sometimes removed, and substituted by a new one which changes the play of the box, preventing a loss of oil and noise.

For remedying that inconvenience we avail ourselves of different dispositions, such as the elastic washers of indiarubber to replace those of leather, in a position between the collet and the nut, connecting as a spring. constantly pressing the collet on the corresponding surface of the box, but these methods have inconveniences which are open to grave objections, and prevent their being popular.

CASE HARDENING.

The cementation and the tempering of axles and axle boxes are of the first importance. The thickness of the cementation should not be less than 1/100th of an inch, and the arm and the box should not be susceptible of being cut with a new file at any portion of their cylindrical frictional surfaces.

The threads of the arm and of the box, the place of the collet and the back of the box ought to be re-heated after the tempering with much precaution to prevent these parts becoming brittle ; in default of a sufficient re-heating, the threads are liable to break under the least shock. Tempering frequently occasions deformations incapable of being rectified.

1. It may tend to curve the arm, and the straightening necessitates every precaution to prevent a break where there is a tendency to crack.

2. If the iron is not very homogeneous, we may obtain arms slightly oval or possibly with some bruises.

That defect is difficult to amend because there is an insufficiency of frictional surface, and the pressure per square inch may be doubled or trebled.

3. If the arm is not entirely welded, if it is not sufficiently sweated, lapped, or if, owing to reasons previously named, the arm presents an interior cavity, fig. 35, its rectification is impossible, and it ought to be rejected.

POLISHING.

The polishing has a triple purpose.

1. The rectification of the deformities due to tempering.

2. To remove the least trace of the tools and to obtain a surface absolutely smooth.

3. To produce a perfect contact of the box on the arm.

After tempering, the arm and the box are each ground on their sides. The bore of the box should be sensibly smaller than the diameter of the arm, and we then proceed to the operation of shooting. The arm should be damped with oil and powdered emery, and submitted to a rotary movement ; the box is then shot on to the arm little by little, and frequently turned in order to preserve the cylindrical form. When it has been shot to the bottom the operation is completed. There should be an equal grinding of the back of the box against the collar of the axle and of the collet against the conical shoulder of the box. The noise that arises from axles very often proves to be caused by the unequal contact of the back of the box on the collar, or of the collet with the conical surface of the box.

It is necessary to assure ourselves that the work of rectification has been well done, and we, therefore, dissolve a little red in the oil between the different frictional parts. If, in turning the box, the red is regularly disposed, it shows that the friction will be distributed over the entire surface.

SETTING.

The setting of the arms is equally important. On it the good functions of the axle depend, and it frequently happens that firing or grinding is entirely owing to defective setting. If the arm is not perfect in the prolongation of the axis of the axle, the wheel drags and produces considerable friction either on the nut, on the collet, or on the arm. It will be easily understood that one effect will be to cause the wheel to run to one side of the extremity of the arm, and that the collet exercises an exaggerated effort which the small frictional surfaces will not support ; in this case the heating of the axle is undoubted.

It is, therefore, necessary in the highest degree that the axles should be carefully set to the road. An axle is correctly set when :

1. The axis of the two arms are in the vertical plan, passing through the axis of the body, *i.e.*, there should be no foregather.

2. The hang of the two arms should be the same angle.

That angle ought to correspond with the dish of the wheels.

If a patent oil axle is truly set, then, in the absence of the leather washer, if the collet and nuts are thoroughly fixed in their respective places, and the box draws and turns freely to the hand without transverse play, the bottom of the cap ought to be ⅛in.

from the extremity of the nipple ; the thickness of the leather washer represents the possible tightening.

ORDINARY AXLES (GREASE).

These axles, fig. 31, are principally employed for vehicles of commerce. Whether the arms are cylindrical or conical, they should be perfectly straight, so that in working their contact with the box may be as exact as possible. For that reason we condemn the grease reservoirs obtained by the circles "a" "a" on the arm, fig. 32, which diminish uselessly the surface of friction which we ought absolutely to respect ; they cause us to make long arms without utility. The most useful grease reservoir is that formed on a certain length of the chief part of the arm, *b*. fig. 31. The two extremities of the arms ought to remain intact as they form two bearings.

The arm of the axle ought to be connected with the body by a taper c.c. sufficiently pronounced ; that detail is important because we know what a large number of axles break at this point.

It is true that this taper causes us to make a corresponding surface on the collar, but as all the collars ought to be precisely machined, that is easy to do, and ought to be carried out with great care so as not to exaggerate the circle. If the throat if properly formed, the solidity of the collar does not suffer. This collar being liable to heat, has to be turned on the axle so that the frictional face may be precisely perpendicular to the axis of the arm. It is of the greatest necessity that the screws of the axles should be perfectly cylindrical, so that the threads may be very full and exact in their bearing with the corresponding surfaces of the nuts. These nuts should be mounted so that they have not the least play ; in default of these precautions, the nuts are liable to become loose in use, and grave accidents are very often the result.

The box of the grease axle should turn very freely on the arm ; a little play on the diameter is useful. They should also be a little shorter than the length of the arm, say $\frac{1}{16}$in. to $\frac{3}{32}$in., according to the dimensions of the axle.

We prefer that the arms should be screwed, one to the right and the other to the left, so that the friction of the box against the nuts may not tend to loosen, but rather to tighten them.

PATENT GREASE AXLES.

This form of axle is not generally employed for pleasure carriages, but for carriages which do not require much care as to cleanliness.

For this reason ordinary grease-axles are not much used. In this axle there is no collet, the friction of the box coming on the collar of the single nut which is turned to receive a leather collar, making the joint.

The box, like that of the patent oil-axle, possesses a reservoir which is case-hardened like the arm.

HALF-PATENT OIL OR MAIL AXLES.

The half-patent axle has neither collet nor nut, the box being secured to the arm by a system of collar bolts and nuts.

We comprehend that the collar of the arm having of itself to support all the efforts, ought to be perfectly welded or better still raised from the solid iron.

The half-patent axle offers the advantage of being oiled easily and rapidly ; moreover, it offers a great security because the wheel is not left to the mercy of one or two nuts which may become loose ; the loss of a cap is not to be feared, and the arm is always lubricated.

For these reasons the half-patent axle has always been the type of the "diligence," and of carriages which ran great distances over rough and deserted roads, and, as a consequence, they were not likely to remain exposed and in distress.

With this axle the tightening is difficult to regulate, and we cannot avoid the loss of oil as we can with an axle of a more perfect make. It is not, therefore, employed for carriages of the better class, as the naves and the back of the box are often covered with oil and are very unsightly.

SPRINGS.

The springs compassed in coachbuilding are composed of a certain number of plates of steel properly tempered.

The plates are compassed according to the desired height of the spring, and they are secured at the middle by rivets or bolts.

STEELS : THEIR COMPOSITION.

All steels are constituted by the association of two simple bodies, iron and carbon. Occasionally we have other bodies introduced for special purposes. They are manganese, tungsten, or wolfram ; but these are for particular purposes. The two important bodies are iron and carbon, and the proportions in which they are united are of the most importance in regard to the properties of the metal obtained. By varying that proportion we obtain the whole series of the products from cast iron brittle and unmalleable, which is the product of more sulphur of carbon, even to mild steel which works like iron, to be tempered and welded very easily ; this is the product of less sulphur of carbon.

For the manufacture of springs, we require an intermediate quality which will receive properly the tempering, and support sufficiently the powerful heat when being worked at the forge, and when having a lugg of iron welded on to it destined to form an eye at the point of attachment, in short, it is necessary that the metal be the most elastic possible, so that it will support after being tempered, the greatest elastic deformations that can be realised.

The steels may be divided into four classes according to their mode of manufacture.

1. Steels of cementation obtained by cementing iron of good quality in boxes full of charcoal.
2. Natural steels obtained by the direct reduction of the ores.
3. Puddled steel obtained by the puddling of cast iron.
4. Cast steel, including crucible steel, Bessemer steel, &c.

The steels of the first three categories are soft and more easily worked than those of the fourth, but they are less homogeneous.

WELDING TEST OF STEEL.

To assure ourselves that the steel is of suitable quality for the construction of springs, we weld on it a piece of iron of very good quality. Swedish iron is very suitable for that purpose, and the welding of the pieces is very easily accomplished. The iron covering the steel is brought to a high temperature, entirely protecting the steel against the too energetic action of the fire.

We might heat them separately, but it is more difficult of execution because we find that the iron and the steel have different welding heats, and one may be burnt while the other is not hot enough.

It is easier if during the weld we cover the part with powdered sandstone or with borax. We employ the borax more particularly when the weld is difficult.

At first its covering protects the piece against the action of the air, and afterwards dissolving the oxides it permits a perfect contact between the metallic surfaces at the moment of the weld.

In certain cases when we wish to weld steel very quickly we employ a special composition made by mixing equal parts of borax reduced to powder with iron filings ; this mixture gives very good results.

TESTS OF FLEXION.

We afterwards try the steel for flexion, and for that purpose we take a bar 1 metre (39·37 inches long), which we bring to a

red heat and give a curve of a calibre corresponding to about the flexion of the trial, in order not to have to test the plate beyond the straight line, which is hardly convenient. We temper with cold water, afterwards re-heating and bringing it to the point of smoking or burning wood, according to the nature of the steel, allow the plate to cool slowly and then submit it to a flexion depending on the thickness of the bar. The following table gives flexions corresponding to the various thicknesses for a length of 1 metre or 39·37 inches :—

TRIALS OF STEEL.

Length of trial bar, 39·37 inches.

Thickness of Steel.	Corresponding Flexions.	Elongation per metre in the most fatigued fibre.
$\frac{3}{16}$in.	$9\frac{1}{16}$in.	$\frac{5}{10}$in.
$\frac{7}{32}$in.	$8\frac{1}{4}$in.	,,
$\frac{1}{4}$in.	$7\frac{1}{2}$in.	,,
$\frac{9}{32}$in.	$7\frac{5}{8}$in.	,,
$\frac{5}{16}$in.	$6\frac{1}{4}$in.	,,
$\frac{11}{32}$in.	$5\frac{7}{8}$in.	,,
$\frac{3}{8}$in.	$5\frac{1}{2}$in.	,,
$\frac{13}{32}$in.	$4\frac{7}{8}$in.	,,
	$4\frac{3}{8}$in.	,,

This test of flexion is equivalent to that which would be undergone by a bar of one straight metre tempered and re-heated, and submitted to a tension sufficient for an elongation of $\frac{5}{10}$in. that which we express as working the steel to a stretching of $\frac{5}{10}$ per metre.

We may indicate here very briefly the formula for calculating the flexions made in submitting a steel plate for producing a determined elongation of the fibres :—

2 P. The load resting on the middle of the plate.
2 l. Its developed length.
f. The flexion of its plate under the load 2 P.
E. The thickness of the steel.
A. The breadth of the steel.
E. The co-efficient of elasticity.
d. The elongation per metre in the fibres most fatigued.
R. The corresponding maximum tension.

As the plate and the load are symmetrical, we may, by the fitting at the middle of the plate, make it support at each extremity a load P ; in that case :—

$$R = \frac{6\ Pl}{A\ l^2}$$

or R = E d, therefore

$$(1)\quad E\ d = \frac{6\ Pl}{A\ l^2}$$

The other part, the flexion f of the plate under the load 2 P is given by the formula

$$(2)\ f = \frac{4\ P l^3}{E\ a\ e^2}$$

between the equations (1) and (2) remove P, we have

$$f = \frac{2\ d\ l^2}{3\ e}$$

so l, the total developed length of the plate, we have

$$l = \frac{e}{2}$$

and, by consequence, $f = \frac{L2}{62}\ d$

In taking, for example, a bar of the length of 39·37 inches, in steel of $\frac{5}{16}$in. thick, and seeking the flexion which will determine an elongation of $\frac{3}{16}$in. in the fibre the most fatigued, we have

$$f = \frac{1}{6 \times 0{\cdot}007} \times 0{\cdot}007 = 0{\cdot}166$$

As it is not advisable to exceed that limit, we have in the table 160 as the value of f.

A few years ago we did not exceed an elongation of $\frac{3}{16}$in. per metre in the trials of steel, but to-day, thanks to the progress realised by metallurgy, we obtain very readily steels which support an elongation of $\frac{5}{16}$in. per metre.

When the bent bar is tried for the first time, it shows a loss of flexibility, but if we submit it to a second test it ought not to show any new loss of flexibility. The first loss of flexibility should not be too great; it should scarcely be more than $\frac{1}{16}$ of the total flexion.

If the first loss of flexibility be too great, it indicates that the re-heating has been too strong, or that the steel is too soft. In the latter case the springs made with that steel will always have a tendency to collapse.

If, upon examination, we find that the steel has borne the various tests well, we may employ it for the manufacture of the springs, but this should not in any manner dispense with the work to which we submit the springs in the special trials, because the heating, tempering, and re-heating are such delicate operations that it is difficult to rely on a corresponding result in the testing of each piece.

We, therefore, submit the springs to further trials.

We cannot too much insist upon the necessity of submitting all springs to a rigorous test, and that from several points of view, but particularly for the forging of the springs, it is an excellent indication of the manner in which we must treat the steel that is employed for the leaf or plate, because we may easily remedy faults in flexibility before a carriage is mounted. The results which the springs give at the trial are, so to speak, a reduced resemblance of the work they will do in service under the carriage.

If a spring loses much flexibility at the trial, that indicates an insufficient temper or a reduction of strength, and, by consequence, it always has a tendency to lose its flexibility. If there is fracture of the leaves, that indicates insufficient reduction, and accidents are always to be feared. For these reasons we would urge the necessity of the trials being imposed again, because they enable us to exercise a control over the quality of the material employed, and the manufacture which may have changed that material.

The only guarantee that we have, the only way in which we can establish the mounting of a carriage with security, consists in a serious trial of its springs; we say a serious trial, because we must not limit ourselves to a seeming trial, as is too often the case.

It is necessary to possess calculations showing what the springs under the carriage will do when subjected to efforts very different to the load in repose; there are the efforts of traction, there are the vibrations, and, in short, there is the prolonged duration of those efforts continuing during months and years, whilst a trial does not last more than a very short time. We, therefore, set limits to the flexion, so that the spring may not lengthen too much under the carriage, but that it may move well, though not beyond that which is desirable, and that which it may do without deterioration.

We now fix that limit.

We have previously seen that we are able to work the steel to an elongation of $\frac{5}{16}$in. per metre, and without going too far we may work it to $\frac{3}{16}$in. per metre as a maximum. That trial is nothing exaggerated, and has long been sanctioned by experience.

The section corresponding to that elongation varies in each particular case, and depends upon the thickness of the leaves, on the manner in which they are drawn, their height, &c. In order to simplify the results in practice, we take an average in considering only the length and the thickness of the back plate.

The table below indicates the flexions for the dimensions most usual :—

Developed lengths of Back Plates.	Thickness of the Back Plates.					
	$\frac{3}{16}$in.	$\frac{1}{4}$in.	$\frac{5}{16}$in.	$\frac{11}{32}$in.	$\frac{3}{8}$in.	$\frac{13}{32}$in.
$31\frac{1}{2}$in.	$5\frac{7}{8}$in.	$5\frac{3}{16}$in.	$4\frac{7}{16}$in.	$3\frac{15}{16}$in.	$3\frac{7}{16}$in.	$3\frac{1}{16}$in.
$33\frac{7}{16}$in.	$6\frac{7}{8}$in.	$5\frac{7}{8}$in.	$5\frac{1}{8}$in.	$4\frac{5}{16}$in.	$3\frac{15}{16}$in.	$3\frac{1}{2}$in.
$35\frac{7}{16}$in.	$7\frac{7}{16}$in.	$6\frac{1}{2}$in.	$5\frac{5}{8}$in.	$4\frac{7}{8}$in.	$4\frac{3}{8}$in.	$3\frac{15}{16}$in.
$37\frac{3}{8}$in.	$8\frac{5}{8}$in.	$7\frac{1}{16}$in.	$6\frac{1}{4}$in.	$5\frac{1}{2}$in.	$4\frac{7}{8}$in.	$4\frac{5}{16}$in.
$39\frac{3}{8}$in.	$9\frac{7}{16}$in.	$7\frac{7}{8}$in.	7in.	$6\frac{1}{8}$in.	$5\frac{7}{16}$in.	$4\frac{13}{16}$in.
$41\frac{5}{16}$in.	$10\frac{3}{16}$in.	$8\frac{5}{8}$in.	$7\frac{5}{8}$in.	$6\frac{11}{16}$in.	$5\frac{15}{16}$in.	$5\frac{5}{16}$in.
$43\frac{5}{16}$in.	11in.	$9\frac{7}{16}$in.	$8\frac{1}{2}$in.	$7\frac{7}{16}$in.	$6\frac{3}{16}$in.	$5\frac{7}{8}$in.

For finding the support that it is desired to give in repose, we employ a special testing machine. In general, it is a lever operating on the spring, the two extremities of which are placed on moveable carriers. The sketch represents such a machine reduced to its simplest expression, and which each may construct for himself at very little expense (see fig. 35, sheet 7.) We limit the flexion of the spring to the distances named in the table by laying a block of convenient length. We measure exactly the flexibility of the spring before the trial and then move the lever in such a manner as to make the spring carry on the block. We release the lever and measure the new flexibility of the spring. It should not have varied. We afterwards take the plates apart and examine the "spring" or "nip" of the plates, that is to say, the distances which separate them when the connecting bolt or rivet is removed. The "spring" ought to decrease regularly from the back plate to the small plate.

When we have two springs of equal range they should have sensibly the same centres. If it is otherwise, it is because certain leaves will have lost more in the trial one than the other, and that the tempering and re-heating have not been sufficiently regular.

The leaves should afterwards be examined one by one for the detection of any cracks which may be present in the steel. Generally they will present themselves in the neighbourhood of the bolt hole or at the extremities of the leaves. They are often very difficult of perception. One of the best means of finding them consists in greasing the leaf abundantly with oil quickly after the trial, and then to submit the leaf to several consecutive flexions, when we find that the oil has penetrated the crack, and renders the defect more manifest.

Apropos of the table of trials we may remark that it will frequently serve when we have to determine the flexibility of the spring.

If, for example, the necessities of the mounting oblige us to give a very great flexibility we ought to consult the table to see that it does not exceed the greatest flexion that may be submitted to the spring. It is good to hold always a little to the under-side.

Suppose, for example, an elliptic spring with a developed length of 37in., the back plate being in steel, $\frac{5}{16}$in. thick, and that we wish to give the greatest compass possible. We ought to see that each plate composing the elliptic may bend $6\frac{3}{16}$in.; in taking $5\frac{1}{2}$in. or $5\frac{7}{8}$in. we, therefore, make an elliptic of 11in. or $11\frac{3}{4}$in. compass.

In all the preceding trials we have spoken of the load that the spring is able to support, and for these reasons. Springs of identical dimensions, same height, same thinning of the ends, supporting well the trials, and carrying sensibly equal loads, made from the same steel and similar in the mode of tempering and re-heating (the co-efficients of elasticity of spring steels vary very little); it is an indubitable fact that when we have two springs alike, supporting equally well the trials referred to and one carrying a heavier load than the other, we may be certain that the dimensions are not identical. Generally, that difference is found in the thickness of the plate, because the flexibility varies inversely as the cube of the thickness, $\frac{1}{100}$th of an inch difference in the thickness, gives a very appreciable difference in the resistance of the spring.

It is not the same for other imaginary qualities we sometimes attribute to certain springs. Some persons imagine that a spring tempered under certain conditions is softer than another; they express themselves to the effect that this spring is softer than that. This is completely inaccurate. If a spring resists well the trials, it is neither more nor less soft than another, and if it does not resist well, it is not a soft spring but a weak spring. There is only one means of having a spring easy and at the same time resistant, and that is by making it very long.

When the spring is loaded under the carriage it effects a series of oscillations, which follow absolutely the law of the pendulum; their duration is proportional to the square root of the length, therefore, the longer the spring the greater the duration of the oscillations, and the easier the spring. This has been remarked for a long time, and a great number of manufacturers have lengthened their springs, rendering them very easy.

MANUFACTURE.

After this rapid analysis of the conditions which ought to be discharged by the springs, we will now examine the manufacture from a practical point of view, insisting on those parts that appear to us to be the most important.

The first operation consists of cutting the steel bars into lengths for the different leaves of the spring; in order to have the least possible waste, we take into account the variations of the length of the leaves to be given at the forge or in the rolling of the eyes.

The ends of the plates are marked at the middle to avoid all error, and to enable us to recover easily those which belong to a spring.

The plates are drawn, by the aid of eccentric rolls, to their extremities, except the back plates, which are rolled to receive a bolt, or are fitted with some other form of joint.

When the eyes, sliding ends, &c., are made at the forge, we weld a "lug" to one or both extremities of the plate, and that weld ought to be very good, it ought to resist successively the action of the tempering and the working under the hammer, and finally the shocks which the spring receives under the carriage.

The ends are forged by means of a series of stamps and dies proper to the form of eye we intend to make. The rolled eyes are simply turned and punched.

The ends being forged, we mark the holes for the open eyes on the bottom of the back plate, we drill these and take care to regulate the back plate very exactly to the required length, which is very essential. We must remember this, so that when the two springs are placed together to form an elliptic they will work equally, as the two back plates ought to be precisely the same in their developed length.

The end is afterwards punched at a red heat, and the plates are collected on a steel mandril put through the holes in their centres when, by the aid of the hammer, they are made to fit perfectly on that mandril; it is then certain to have the necessary play between the end and the eye for avoiding to the last any alteration in the end when the bolt is a little worn; we correct at the same time any warps in the square and any other difficulties which may have occurred during the operation. It happens sometimes that the length of the plate varies from $\frac{1}{16}$in. to $\frac{1}{8}$in., we ought, therefore, to verify it with another, and modify it if there is reason.

The drilling of the holes being completed, we mark the exterior diameter of the eyes. The excess of iron is taken off by means of a special appliance, permitting of giving to the piece a rotary movement, and to the tool a vertical and horizontal movement, thus obtaining the iron well rounded, and all the exterior parts and the end well formed.

The two back plates, one end with a rolled, and the other with an open eye, are tried together. As to the other leaves, they are drilled with a hole in their centres and afterwards heated in a gas furnace, and drawn or tapered by means of eccentric rollers. We may vary the eccentricity in accordance with the taper or draw we wish to obtain.

In the same heat we emboss the nibs of the leaves.

By the aid of the machine we cut the ends of the plates to the form required, and we make the slits to receive the nibs. By the aid of the hammer and the file, we remove the imperfections which may exist in the slits and the nibs to assure ourselves that one plate will work regularly on the other.

The spring is taken for the bending and tempering to a special machine with two cylinders, the steel plate at a red heat is tempered in a reservoir of cold water, and afterwards re-heated and brought back to the point of burning wood with the greatest care.

This kind of tempering is the most convenient and best for the springs; in effect, the exterior fibres of the steel plates which are subjected to the greatest elongation are precisely those which receive the most complete re-heating, whilst the interior fibres receive a more feeble re-heat, they are much more drawn to the middle fibre, and, as a consequence, they have elongation to support.

After the plates are brought back we adjust them by the hammer, giving the convenient set, and correcting the deformations due to the tempering and straighten them, so that one will play perfectly on the other.

After the adjusting of the open and the rolled eyes, they are sometimes found to be twisted; if on trial with the square this is found to be the case, we heat slightly the two ends and rectify their position by the aid of the hammer and other tools.

The spring is then subjected to a trial under the conditions previously indicated.

During that trial we assure ourselves that the spring works conveniently, we diminish the load and make it oscillate—the oscillations ought to be regular.

We examine also the deformations of the spring, the back plate should not present any disagreeable deflection, and all the parts of the spring should have preserved their respective compass; if some have lost more than others, they ought to be re-tempered and submitted to another trial, and rejected if they are not firm.

After the trial and the improvements have been made, the spring is ready for grinding.

In that operation we ought to take away the excess of breadth produced by the lamination, and perfectly dress the side faces taper and clean the visible parts to form the bevil, and round the edges of the plates. This work ought to be done by very abundant grinding, with a free use of water, so as not to detemper the plates by the elevation of temperature due to the friction.

The spring is afterwards filed, we finish the ends and attend to the parts which have not been reached in the grinding. We finish the bevils, drill the eyes to the exact dimensions of the bolts, and we fit the nibs of the back plates.

Finally, at the emery grindstone we perfect the ends of the plates, and we narrow slightly their extremities, polishing also their bevils. In that operation the action of the grindstone is very light, there is no fear of detempering the steel, the heat produced being very insignificant.

That operation finished we grease the plates in order to facilitate their sliding one on the other.

The greasing is very important, and in measuring the flexibility of a spring ungreased with that of the same spring well greased, we find sometimes a difference of even $\frac{1}{10}$th.

We afterwards put the plates together, fit the bolts into the eyes, and submit the spring to a last trial, which should not produce any loss of flexibility.

That trial is necessary for assuring us that the plates have not been altered in the various operations that the spring has undergone.

The spring is then completely finished, and presents all the qualities that we may desire.

CARRIAGES,

BY

WILLIAM GARDINER,

DELEGATE FROM THE DUBLIN COACHMAKERS.

(*Reprinted from the "Dublin Evening Telegraph."*)

BODYMAKING.

IN taking a general view of the carriages in the Exhibition, the designs in this branch seem to be old-fashioned, the broughams, landaus, and barouches being of a pattern if not exactly similar to, at least resembling very much, those in use in this country about thirty years ago, as many of them have the old-fashioned bottom-sides which go right through under the doors, as in those of a date long before the period I have named. Whether this is an attempt on the part of the French to revive the old style, or whether it is that they have never entirely abandoned it, I cannot say. Some few of the carriages are of a modern design, being much like those of this country or of England, though in all cases the boots had a heavy appearance, inclining towards the old style, the upper part being nearly as wide as the seat. In no instance did I see the slender proportions and neatness of outline of those of our own carriages. Their family omnibuses I admired very much. The bodies are particularly neat and light-looking, the front-pillars and boot being exactly the same as a single brougham, the hind-pillars in some being round, in others the corners flat, as in an octagon, and in more the backs were made angular, the corner-pillars and door-pillars forming the angles. There are no panels from the waist up, the front, back, and sides being all of glass except where the pillars intervene. In their victorias and phaetons, as well as their two-wheelers, I could see nothing to recommend, some of them being much like our own, and others having a most antiquated appearance. There was one landau in an unfinished state, which for lightness and cheapness of build I have never seen anything to equal; the heaviest timber in it could be got out of a two inch plank. There were, of course, no glass frames in the doors, the pillars above the doors inclining towards each other, and being evidently intended for curtains. We have often seen cheap flimsy work imported into this country from England, but all their efforts in this direction were thrown into the shade by this one article. There are some things which, if introduced into this country, would be looked upon as a new departure. It can be imagined what a landau would be like having a canopy supported by iron stays from the corners, instead of the usual head, and being fitted with curtains all round, which can be drawn apart or closed up, as may be required; or a four-in-hand drag with the side panels and doors from the elbows up taken away, the front and back panels and roof remaining, curtains in this case doing duty for the panels. They have a light and airy appearance, and may possibly be suitable to the climate of France, but I doubt very much, with the changeable weather of this country, whether such an innovation would be approved of.

CARRIAGE-MAKING.

Of this branch there is nothing favourable whatever to be said, the forecarriage, as a rule, being of the one pattern. They are, in fact, a facsimile of each other in every respect except that of size, and I conclude that they are all made in the one factory, from which they are purchased by the coachbuilders ready for use. This forecarriage is by no means a stranger in this country, having been imported into it for years, and is so well known that a description of it seems superfluous. It consists of a top and bottom transum of wood, the top one having no plate on the upper surface, but as a substitute for it there is welded to each side of the wheel-plate a plate which is brought out as far as the bolt that fastens the top carriage to the body, the rase-plate being the only other iron on this transum. The horn bar is also of iron. In the bottom the transum-plate is brought out to the wheel-iron, and goes in under it, terminating at the outer edge. There are no "T" ends on the bottom plate, and the wheel-iron heads, being only about four inches in length, make rather an insecure bearing for the spring. The futcheles are of iron, and extend to a most unnecessary distance beyond the hind felloe piece, the back ends of the wheel-iron stays being brought to their extreme ends. There is nothing whatever in this forecarriage to recommend it but its cheapness, a quality which is in no proportion to its want of beauty and durability. It is heavy and clumsy in appearance, and altogether unlike the forecarriages of this country, with their lightness of appearance, their graceful sweeps, and with all the strength that is wanting in the others. It would seem as if the French looked upon the forecarriage as a mere necessity, and as in no way having to contribute to the general beauty of the article. There were a large number of four-in-hand drags, the fore-carriages of which were of the rudest description. I have seen more skill and taste displayed on the forecarriage of a furniture van or a brewer's wagon in this city than on any one of them. There was one only that deserved any notice, and that for its novelty alone. This was so constructed that the direction of the front wheels could be changed without altering their position on the ground. This result was accomplished by having an independent axle for each wheel, there being two arms on each axle—a perpendicular one and the usual horizontal one. The box of the upright part of this axle was attached to the end of the bed-plate, and close up to the spring on the outside. The felloes of the wheels are quite close to this box, and the axle is brought down behind the spokes, turning inward to get clear of the stock when it takes an outward turn into the wheel, the dish of the wheel bringing that portion of it that is on the ground directly under the upright box. It will be seen from this that when the upright portion of the axle turns in its box that the wheel retains its position on the ground, though facing in a different direction. The splinter-bar is supported by powerful iron stays, which unite at the centre of the bed (there being only one), the perch-bolt passing through. From this the stay extends backwards, where it is connected with a cross-stay by a joint. This stay in its turn is connected with other stays at its ends, which are fastened to the upright portion of the axles. The moving of the pole sets all in motion, turning the axles and producing the effect I have described, the stays which are attached to the axles being of such a length as to act as lock-stops. The tendency of carriages to lean to one side when the forecarriage is locked, especially in compass or eccentric carriages, is here avoided, the wheels, acting as supports to the vehicle, always remaining in the one position. There must be great friction on the collars of the upright portions of the axles, they having to bear the whole weight of the front of the carriage ; and, again, the leverage which is brought to bear on the bed-plate must be great, it having, in supporting the perpendicular box, to bear the whole strain. We have for many years been trying, by means of the oval wheel-plate and in other ways, to get the forecarriage to turn in a short space, but without any satisfactory result. Here we have the object attained without any space at all being required. With regard to the general hanging of the carriages there is nothing whatever worth mentioning.

SMITHWORK.

In this branch I found the work to be uniformly of a good quality, and, in fact, superior in finish to the general run of ironwork at home, though, as a rule, it was far heavier than was necessary for the work it had to do. In these days of one-horse carriages this unnecessary weight is a serious drawback, detracting considerably from the saleable properties of the article. The superiority of the work is in no way due to any corresponding superiority of the French smith over that of our own, but to the fact that more attention is given to it while in the vice than is given to it over here, the French viceman improving the form of the iron, and carrying out the ideas of the smith, while at home it is thought sufficient to brighten it, and it leaves the vice, with rare exceptions, the same shape as when it entered it. It seems a pity that an article so costly as coach ironwork, and which plays such a prominent part in the appearance of the carriage, should be left unfinished for the sake of a trifling additional expense. I noticed in the English section that the tendency was in favour of light ironwork, and to such an extent was this carried in some instances that it appeared untrustworthy. In no instance did I see better judgment displayed in making the iron of a strength proportioned to the work it has to do than at home. All the brakes that I saw were on the screw principle. There is nothing in the brakes exposed to view but the arms which bear against the wheels, and a small wheel beside the driver for working it. The screw in some is brought in on top of the driving-seat, in which there is a slit through which it is connected with a crank inside of the boot, the other arm of the crank having a chain attached to it, which is conducted through the inside of the body to the brake behind, passing over and under rollers as the form of the body may require. In this case the driving-box is fitted over the screw, where all is hidden from view. In others the screw is taken through the boot side, immediately under the seat-valance, the interior arrangement being the same. This is a very effective brake, and a great deal of ironwork, which is often unsightly and almost useless, is done away with.

WHEELING.

In this branch there is nothing whatsoever to speak of, the wheels in use being either the Warner patent, or those in common use in this country. I noticed on some of them that the edges of the tires were round, and overhung the felloes, acting as a protection both to them and to the paint.

PAINTING.

The work in this branch was exceptionally good, having a clearness and finish that is not often found at home. It would be unsafe to give a positive opinion as to the cause of this, the first impression being that more time and material had been expended on it than is usual at home. It may be that some better system of bringing forward the work may exist in France, which I had no means of ascertaining, or, as is very probable, greater pains was bestowed on it, on account of being intended for exhibition. In this branch, above all the others (each successive coat of paint hiding the one which preceded it), there is no means of discovering the cause except by actual observation. The colours are the same as those in use in this country, and the striping varies from the almost imperceptible black stripe on its dark ground to that of the extreme of gaudiness, where the ground colour itself is little more than a stripe from the profusion of lines that are on it. On some of their carriages, but especially their omnibuses, they have the corners of the panels filled in with gilt stencil work, and the waists completely covered with it. I could not recommend this style of decoration, being, in my opinion, more suitable for the perambulator than for the carriage.

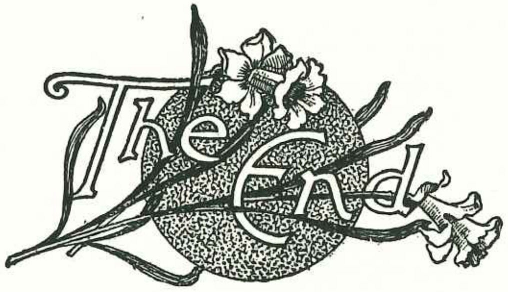
TRIMMING.

This branch is essentially a study for a trimmer. He stands in the same position in regard to coachbuilding as the upholsterer does to the cabinet trade. On this deputation to Paris the upholsterer was represented as well as the cabinet maker, whilst, unfortunately, our trimmer was not. The trimming in the Exhibition was very neat, and I would say was on a par with our own, the style being of the pleated pattern, and the materials much the same as our own. In the leather work I found that the stitching was remarkably small and neat.

In the remarks which I have made on the different branches I have made very little allusion to the carriages in the English section, as they are, with very little exception, identical with our own.

If the foregoing report should be thought unsatisfactory or incomplete, it must be borne in mind that in the trade which I have the honour to represent, there are seven distinct branches; that in the Exhibition there were more carriages than would fill all the showrooms in Dublin twice over; and that I had but three days in which to inspect them, a considerable portion of this time being lost in looking for the place where the carriages were located. If I were to give to each branch of the business the amount of study

and attention that would be required in order to give a full and comprehensive report, it would take as many weeks as there were days at my disposal. However, a very short time only was necessary to convince me that, taking the exhibits altogether, there was nothing better than could be seen in the showrooms of this city. Those who require carriages can get them at home as good as can be had elsewhere, if they give the price for them, and they who imagine that a good article can be had at a low figure are labouring under a delusion. That a short time will serve to dispel. When the trade that is taken to London and elsewhere, through pure fanciful notions, is left at home; when, in fact, we are no longer compelled by the action of the wealthy people of our own country to play second fiddle, it will be seen that neither our manufacturers nor workmen are inferior to those of other countries.



INDEX.

PAGE.
AMERICAN CARRIAGES 26
Arbitration 32
Artisan Reporters II.
Atkinson & Philipson—Drawings at Paris 5
Automatic Heads 41
Axles 22—51—52—53—67
  Manufacture of -53—67
  Ordinary (grease) 66
  Patent (grease) 66
  ,, (oil) 60—64
  Half-patent 67
BARR, A. W.—DRAWINGS AT PARIS -5—IV.
Beauty and Utility VII.
Bent Timber 10
Body-making 5—78—79
  ditto see Works of Reference appendix
Brakes 22—23—81
Brake Blocks 22
Bristow, Col. III.
Broughams VI.
Butler, L. T. III.
CARRIAGE MAKING 79
Carriage Tax in England VII.
Carriage Tax in France 31
Carriage capable of 15 transformations 10
Case-hardening 64
Casson, W. T. III
Cee-springs (imitation) -18—49
Coachmakers' Company III.—V.
Coachmaking in general—see Works of Reference appendix
Collection of Drawings and Paintings (methods of transport) 5
Collinge's Axle 60
Conseil des prudhommes -31—47
Co-operation V.
Cooper, J. & C.—Coachbuilders' Art Journal appendix
Coward, Thos. III.
Crystallization of Axles 54
DELEGATES, MEETING OF 46
"Draught" and "Suspension"—see Works of Reference appendix
Dupont, A. -30—45
Dutch Carriage 20
EDUCATION OF BRITISH AND FOREIGN WORKMEN VIII.
English Carriages, Scanty Show 37
English Styles Copied 5
Export Trade of the French 26

PAGE.
71
FLEXIBILITY OF SPRINGS - 72
Flexions, Table of - III.—appendix
Foggett, J. S. - -56—57
Forging Axles - 69
Formula for calculating Flexions - III.
Freedom of London - I.
French Exhibitions - -31--33
  ,, Workmen - -38—39
  ,, Trimmers (methods of working) - 20
Futchels - 6
HEAVINESS OF FRENCH CARRIAGES - 9
Head-joints and Head-plates - appendix
History of Coachmaking—see Works of Reference - V.
Holmes, Chas. - VII.
Holmes, H. M. - III.
Hon. Freedom of Coachmakers' Company - IV.—VI.—VII.
Hooper, G. N. - 5
Hooper & Co.—Drawings at Paris - IV.—V.
IMPORTS AND EXPORTS OF BRITISH CARRIAGES - 27--28
Import Duties on Carriages—France, United States, Argentine Republic -20—21
Interchangeable Parts - -IV.—5
Institute of British Carriage Manufacturers - 78
Irish Report - 15
JOINTED PERCH - 8—9
Joints in body-making - V.—VI.
Juries - 17
KELLNER'S TIRE - appendix
Kemp, John, & Co.—"Carriage Builders' Gazette" - II.
Kinggate, C. - -31—33
LABOUR (conditions of) in Paris - 44
Laces - -42—43
Leathers for Coachmakers - 4
Location of various Exhibits - II.
Lord Mayor of London - II.
MANSION HOUSE REPORTS - -53—67
Manufacture of Axles - -73—76
  ,, ,, Springs - 5
Methods of Transport (collection of drawings and paintings) - 38
  ,, ,, Working - 7—41—42
OCCASIONAL SEATS - 6
Open Quarters - 44
Order and Cleanliness in Workshops and Showrooms - II.
Organization of French Coachbuilders - 23—26—82
PAINTING - appendix
  ditto see Works of Reference - 9
Paris Cab Company's Exhibit - III.—IV.
Peters, J. W. - appendix
Philipson, Jno.—"Harness" - ditto
  ditto "Coach-body Making" - III.
Philipson, William, A.Sc. - -11--13
Piece-work—Prices for body-making - -14—80
Pivotted Axle

PAGE.
Polishing Axles - 64
Preface, by John Philipson - I.—VIII
Prices of some Carriages in the Exhibition - 13
Prices of Carriages in the Show-rooms - -13—14
Prices for Ironing Carriages - -19—20
Private Omnibuses - 78
Profit Sharing - V.
Proportion - 5
ROBERTSON, JNO. - VII.
Robertson, J. - II —III,
Roumanian Carriages - 21
SETTING AXLES - 65
Smithwork - 81
  ditto see Works of Reference - appendix
South American Carriages - 7—10—28
Spring Bolts - 19
Spring Plates (shapes of) - 18
Springs - 18—19—49—50 -51—67—76
  (manufacture of) - 67—76
Steel Body Plates - 8
Steels (their composition) - 67
Steps and Step Ladders - 21
Superiority of English Work - 33—48—83
  Suspension"—see Works of Reference - appendix
TECHNICAL EDUCATION IN PARIS - 28—29—30
  ditto in England - VIII.
Technology of Carriage Building—see Works of Reference - appendix
Test for Axles - 55—56
Tests of Flexion - 68—69
Text Books—see Works of Reference - appendix
Thrupp, G. H. - VIII.
  ditto "History of Coaches" - appendix
"Timber"—see Works of Reference - appendix
Trade Journals—see Works of Reference - appendix
Trays - 44
Trial of Steel - 69
Trimming - 23—26—36—47—82
  ditto see Works of Reference - appendix
Troubles of Artizan Reporters - III.—3—4—36
Turning axle-Arms - 60—64
UGLINESS OF SOME AMERICAN CARRIAGES - 5
Under-carriages - 14
"Under-carriage Making"—see Works of Reference - appendix
Uniformity of Sizes - V.—20
WAGES OF FRENCH WORKMEN - 11—13—46
Welding test of Steel - 68
Wheels (various) - 16—17
  ,, (Warner) - 15
  ,, (with felloes) - 15—16
Wheeling - 81
"Wheelmaking"—see Works of Reference - appendix
Wheel Plates - 20
Whitehead, Sir James - II.

TECHNOLOGY
OF
CARRIAGE BUILDING.

WORKS OF REFERENCE.

HISTORY.

Adams, W. B.	"English Pleasure Carriages"	1837, out of print.
Felton, William	"A Treatise on Carriages"	1796 ditto
Fuller, —	"Essay on Wheel Carriages, with a concise view of their origin"	1828 ditto
Hooper, G. N.	"Jury Reports and Lectures on the Carriages of the International Exhibitions, 1855 to 1888"	
Lebrun, —	"Manual for the Carriage Builder and Wheelwright" (Paris)	1851.
Roubo, —	"Coachbuilders' Guide" (Paris)	1770, out of print.
Stratton, E. M.	"The World on Wheels" (New York)	1878.
*Thrupp, G. A.	"History of the Art of Coachbuilding"	1877, Kerby & En dran, Ldon. 10/6

BODYMAKING.

Mather, J. G.	"The Cant Board Explained" (Newcastle)	1856, out of print.
Mattison, Thomas	"A Practical Treatise on Coach-body Making"	McCorquodale & Co., Leeds. 10/6.
*Philipson, John	"Technicalities of the Art of Coach-body Making"	John Kemp & Co., London, E.C. 4/-.
Thomas, Brice	"Menuiserie en Voitures"	1870. 135, Boulevard Haussmann, Paris.

COACH-MAKING IN GENERAL.

Beaufort, His Grace the Duke of	"Driving"	1889. Longmans, Green, & Co., London. 10/6.
Burgess, J. W.	"A Practical Treatise on Coach-building"	1881. Crosby, Lockwood, & Co. London. 2/6.
Foggett, J. S.	"A System of Book-keeping for Coach-makers"	1890. John Kemp & Co., 46, Cannon St., E.C. 2/6.
Forney, M. A.	"Car-builders' Dictionary"	New York.
Hooper, G. N.	"Carriage-building in England and France"	1890. Journal of the Society of Arts
Ditto	"Modern Carriages," being a contribution to "Driving"	1889. Longmans, Green, & Co.

* Approved by Mr. G. A. Thrupp as text books for technical classes.

Coach-making in General (*Continued*).

Richards, T.	"Wood Conversion by Machinery"	London.
Institute of British Carriage Manufacturers.	"Official Reports of Transactions"	Secty.'s Office, Pancras Lane, Queen St., E.C.
Ware Bros.	"Coachmakers' Illustrated Handbook"	Philadelphia, U.S.A.
Worshipful Company of Coachmakers.	"Artizan Reports on Carriages at the Paris Exhibition, 1878"	1879. London.
Mansion House Committee, Whitehead, Rt. Hon. Sir James (Lord Mayor.)	"Artizan Reports" by J. Robertson and C. Kinggate	1889. C. F. Roworth Gt. New Street, Fetter Lane, E.C.

UNDER-CARRIAGE MAKING.

Budd, G. F.	Prize essay on "The Under-works of Carriages"	John Kemp & Co., E.C. 2/6.

DRAUGHT AND SUSPENSION.

Clarke, D. E.	"Railway Machinery & Rolling Stock"	London.
*Foggett, J. S.	Prize essay on "The Manufacture of Carriage Springs"	1886, J. Kemp & Co., E.C. 2/6.
Morin, A.	"Experiences sur la Tirage des voitures"	1842. Paris.
*Philipson, Wm.	Prize essay on "Draught"	Jno. Kemp & Co E.C. 2/6.
* Ditto	Prize essay on "The Suspension of Carriages"	1889. Hub Publishing, Co New York. 5/-.
* Ditto	"Brakes for Retarding Carriages in Descending Inclines"	1888. London.

SMITHWORK.

Crane, W. J. E.	"Smithy and Forge"	Crosby, Lockwood & Co., L'don. 2/6
Richardson, M. T.	"Practical Blacksmithing" (3 vols.)	"Blacksmith and Wheelwright" Office, New York. 3 dollars.

WHEELMAKING.

*Foggett, J. S.	Prize essay on "The Manufacture of Carriage Wheels"	1882. John Kemp & Co., E.C., 2/6

PAINTING.

Boag, A.	"Coach Painters' Guide"	1890. P. J. Jackson, N'castle. 12/6.
Church, Professor	"Chemistry of Paints and Painting"	1890. Seeley & Co., London. 5/-.
Gardner, F. B.	"Carriage Painters' Manual"	1883. New York.
Marlot, —	"Complete Guide for Coach-painters" (from the French)	New York.
Schriber, Fritz	"Complete Carriage & Wagon Painter"	1885. T. M. Richardson, New York. 1 dollar.
*Simpson&Thrupp	"Handbook for Coach-painters"	1888. J. & C. Cooper, London. 1/-.

* Approved by Mr. G. A. Thrupp as text books for technical classes.

TRIMMING.

*Farr & Thrupp	"Handbook for Trimmers"	1889. Chapman & Hall, London.
Fitzgerald, W. N.	"Carriage Trimmers' Guide Book"	Harness - makers Journal Office, New York.

HARNESS-MAKING.

Fitzgerald, W. N.	"Harness Makers' Manual"	1885. Harness-makers' Journal Office, New York.
*Philipson, Jno.	"Harness: As it has been, as it is, and as it should be"	E. Stanford, Charing Cross. 5/-.

TIMBER.

Foggett, J. S.	"Coach-makers' Timber"	Jno. Kemp & Co., London. 1/-.
Laslett, T.	"Timber and Timber Trees"	

TRADE JOURNALS.

PUBLISHERS.	NAME OF JOURNAL.	ADDRESS.
M. T. Richardson	"Blacksmith and Wheelwright"	84, Reade Street, New York, U.S.A.
Ware Bros.	"Carriage Monthly"	Market Street, Philadelphia, U.S.A.
Krehbiel & Co.	"Carriage World"	248, Walnut Street, Cincinnati, U.S.A.
J. & C. Cooper	"Coach-makers' Art Journal"	111, Long Acre, London.
G. Meitinger	"Der Chaisen-und Wagenbau"	Munchen.
Brice, Thomas	"Guide du Carrossier"	135, Boulevard Haussmann, Paris.
HubPublishingCo.	"Hub"	6, Barclay Street, New York.
	"La Carrosserie Francaise"	Paris.
Jno. Kemp & Co.	"Saddlers, Harness Makers, and Carriage Builders' Gazette"	46, Cannon Street, London, E.C.
Gohen & Co.	"Spokesman"	62, Longworth St., Cincinnati U.S.A.

* Approved by Mr. G. A. Thrupp as text books for technical classes.

TECHNICAL WORKS ON CARRIAGE BUILDING

PUBLISHED BY
JOHN KEMP & CO.,
46, CANNON STREET,
LONDON, E.C.

The Technicalities of the Art of Coach-Body-Making,
With 55 Illustrations,
By JOHN PHILIPSON,
Vice-President of the Institute of British Carriage Manufacturers; Member of the Worshipful Company of Coachmakers, the Institute of Mechanical Engineers and Society of Arts, etc.; Author of "Harness: As it has been, as it is, and as it should be," etc., etc.
PRICE 4s.

A Treatise on Coachmakers' Timber,
By JOHN S. FOGGETT. Price 6d.

THE SEASONING OF WHEEL TIMBER,
By JOHN S. FOGGETT. PRICE 6d.

A Treatise on the Underworks of Carriages,
With 32 Illustrations,
By G. F. BUDD. PRICE 2s. 6d.

THE MANUFACTURE OF CARRIAGE WHEELS,
With 20 Illustrations,
By JOHN S. FOGGETT. PRICE 2s. 6d.

DRAUGHT, With 8 Illustrations, By Wm. Philipson, *Of Newcastle-on-Tyne.*
Associate of Science, Durham University; Graduate of the Institute of Mechanical Engineers, and of the Institute of British Carriage Manufacturers; Certificated Teacher for the City Guilds of London Institute by full Honours Certificate in the Examination on Coachbuilding.
PRICE 2s. 6d.

ESSAY ON SPRINGS, By JOHN S. FOGGETT,
PRICE 2s. 6d.

A

SYSTEM OF BOOK-KEEPING

FOR

COACHMAKERS,

BY

JOHN S. FOGGETT.

1890.

LONDON:
JOHN KEMP & Co., 46, Cannon Street,

PRICE 3s.

REPORTS

ON THE

CARRIAGES

IN THE

PARIS EXHIBITION,

1889,

BY

ARTISAN REPORTERS,

SELECTED FOR THE DUTY BY THE

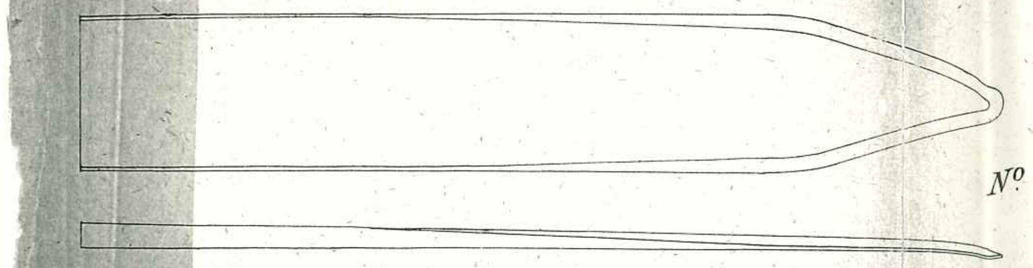
INSTITUTE OF BRITISH CARRIAGE MANUFACTURERS.

EDITED AND REVISED BY

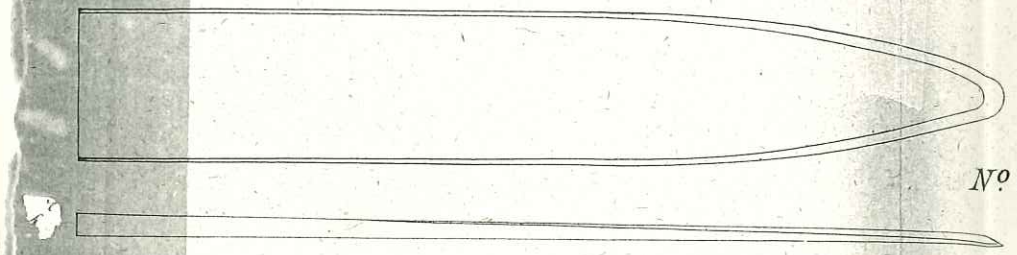
JOHN PHILIPSON, J.P., M.I.M.E.

1890.
LONDON:
John Kemp & Co., 46, Cannon Street.
Newcastle-on-Tyne: Mawson, Swan, & Morgan.

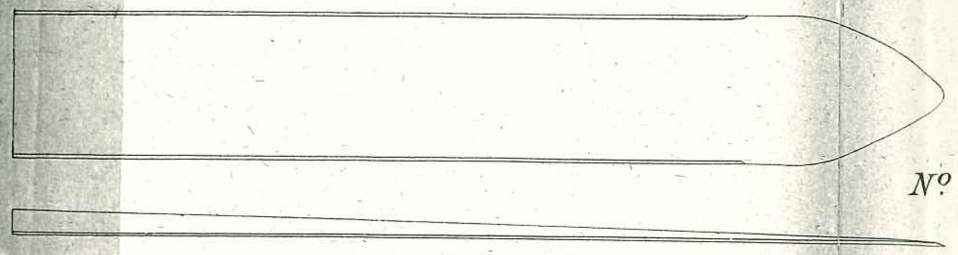
PRICE 5s.



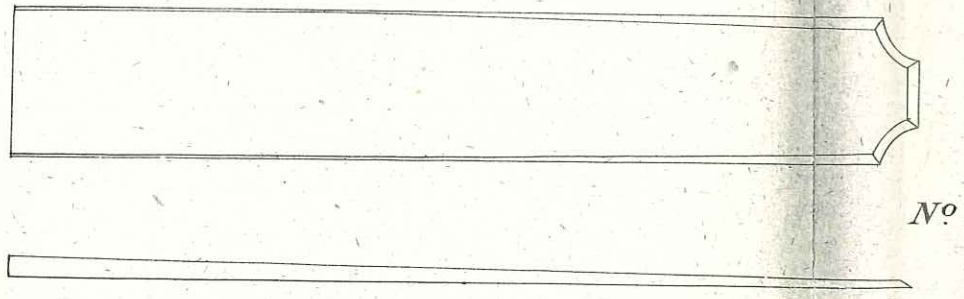
Nº 1.



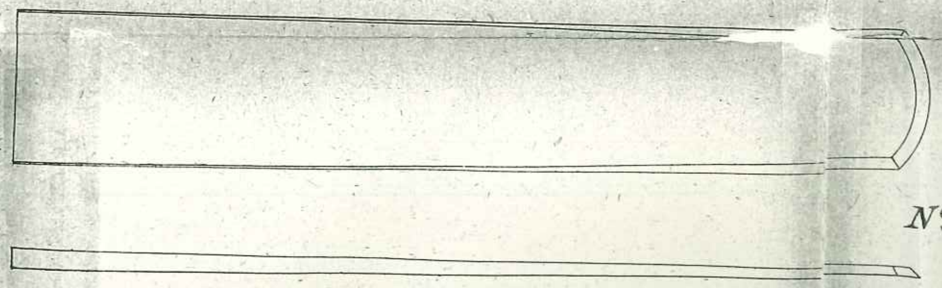
Nº 1ª



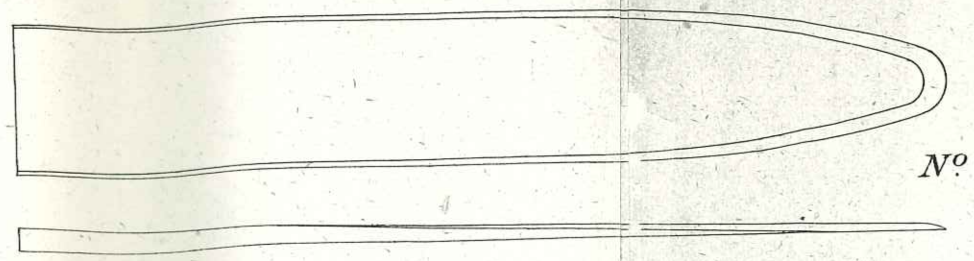
Nº 1^{b}



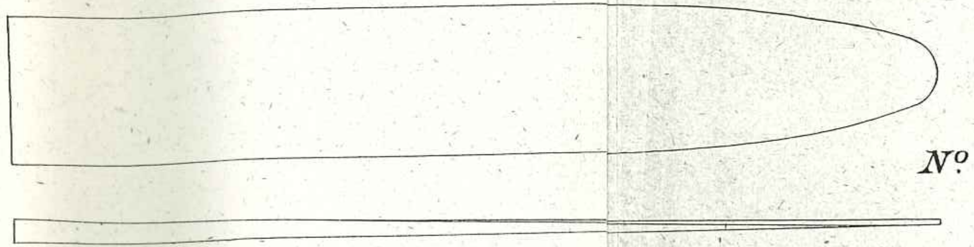
Nº 2.



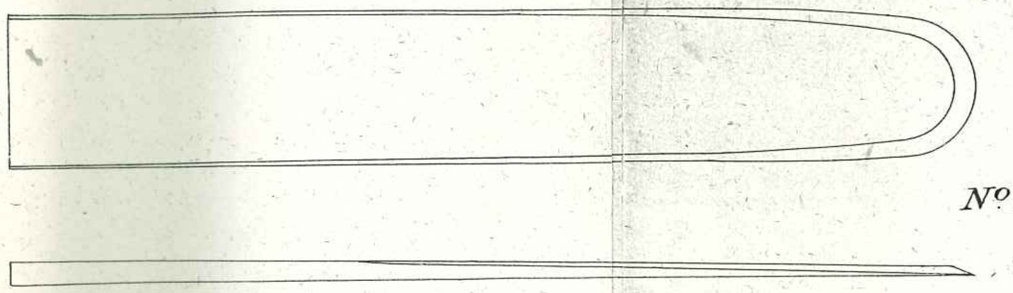
Nº 2ª



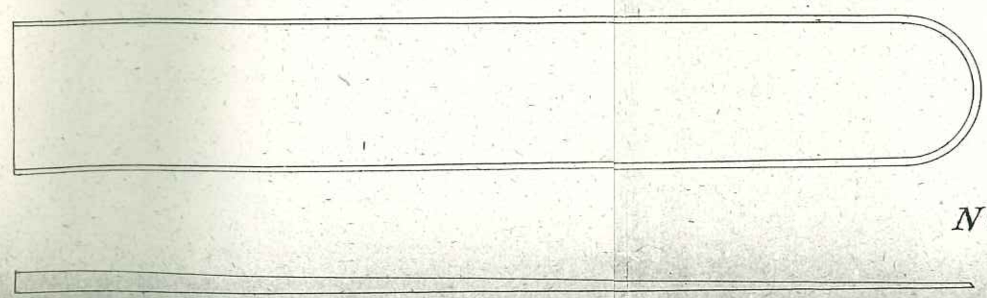
Nº 3.



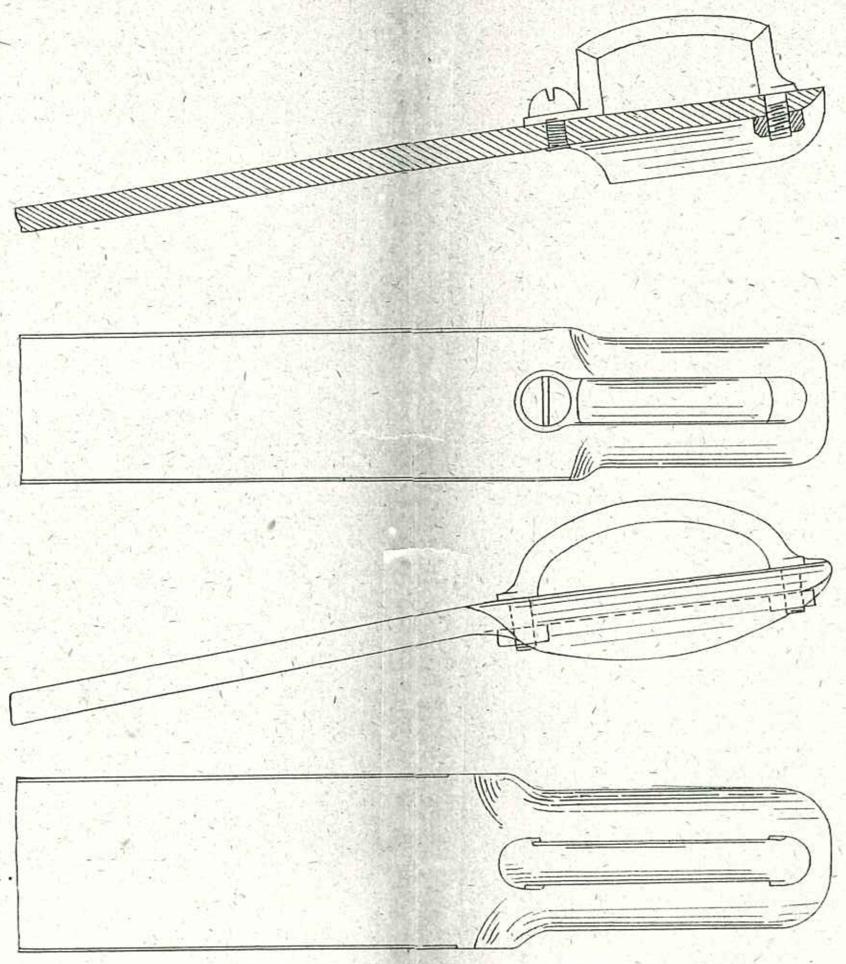
Nº 3ª



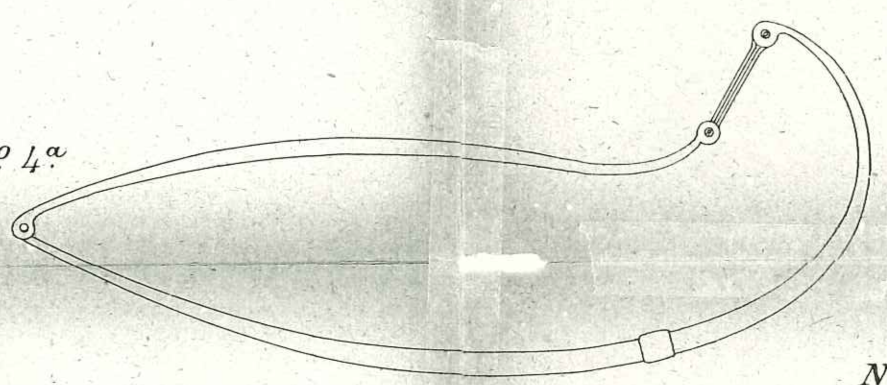
Nº 4.



Nº 4ª



Nº 5.



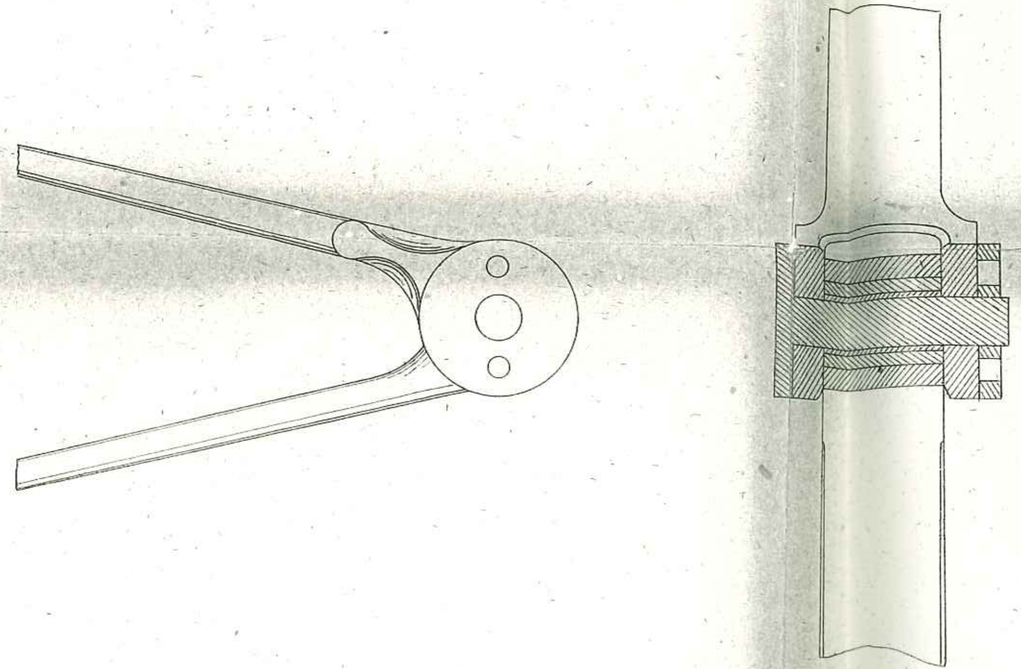
Nº 6.

A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

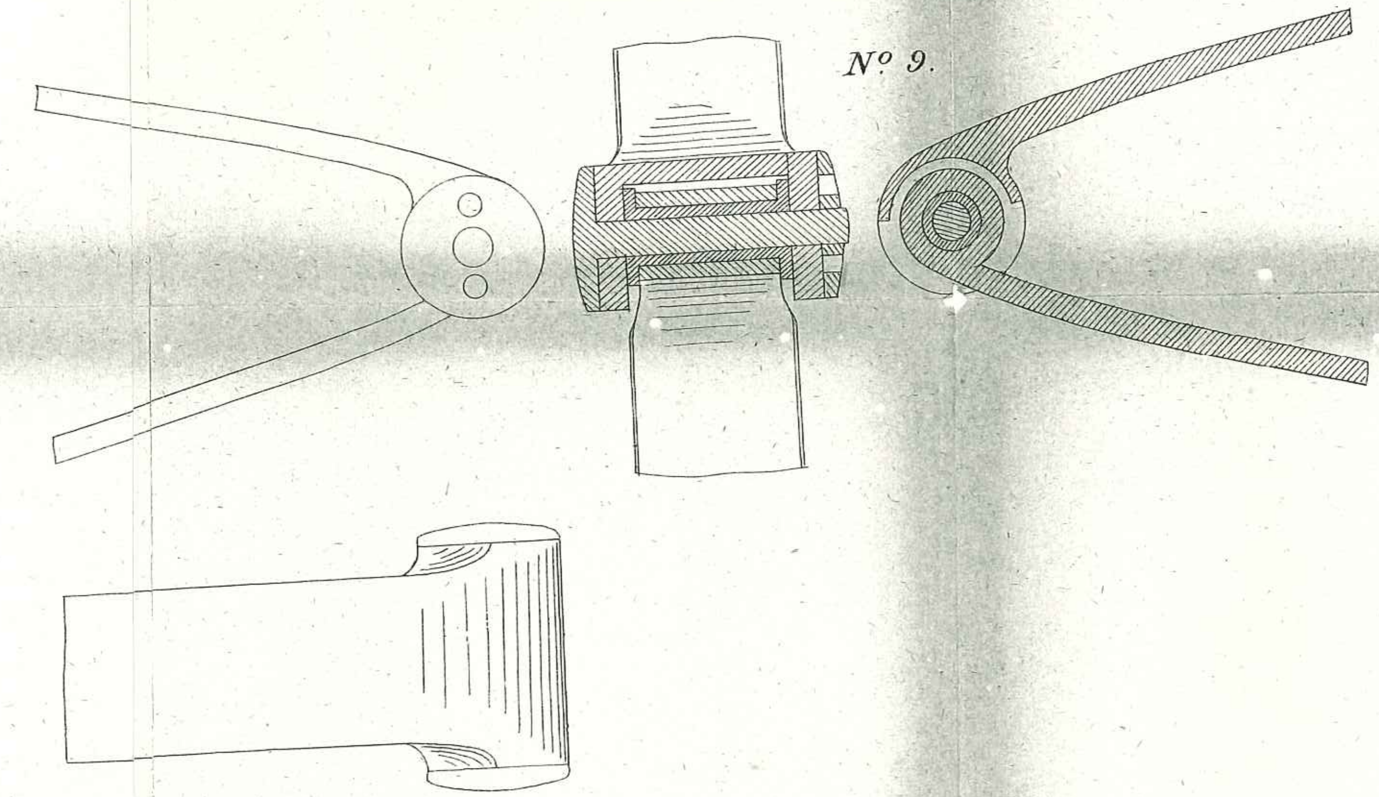
SHEET 1.

Lithographed by JOHN KEMP & Co.

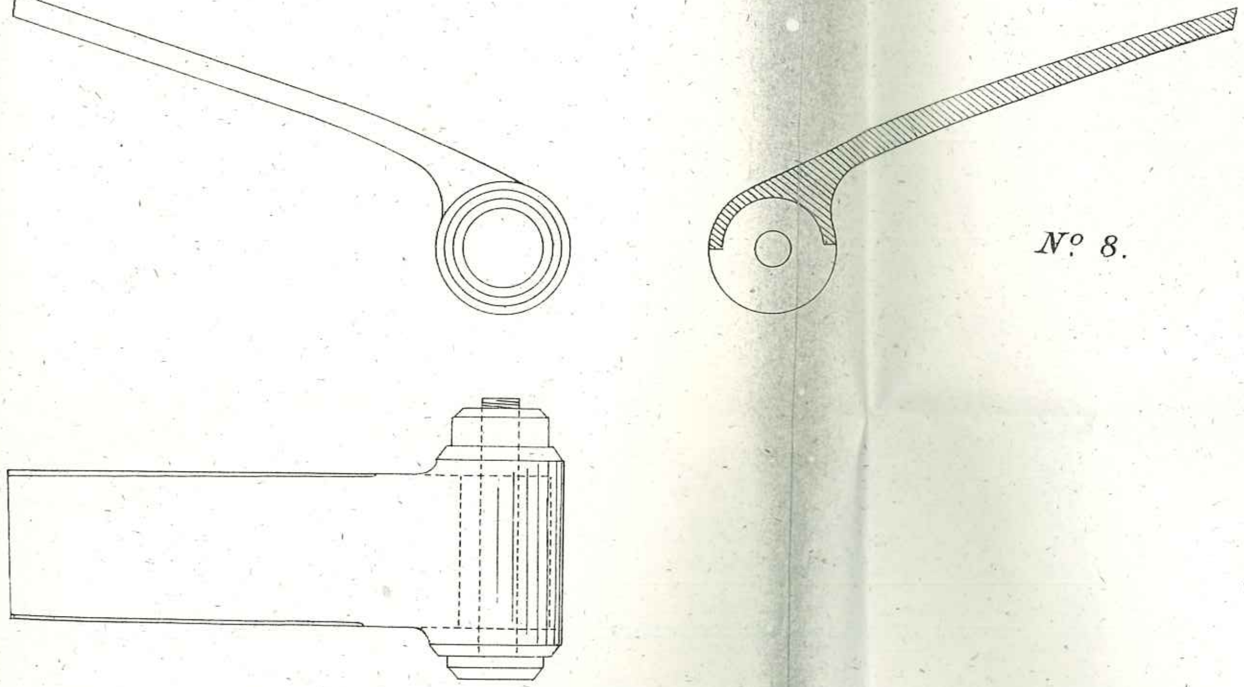
Nº 7.



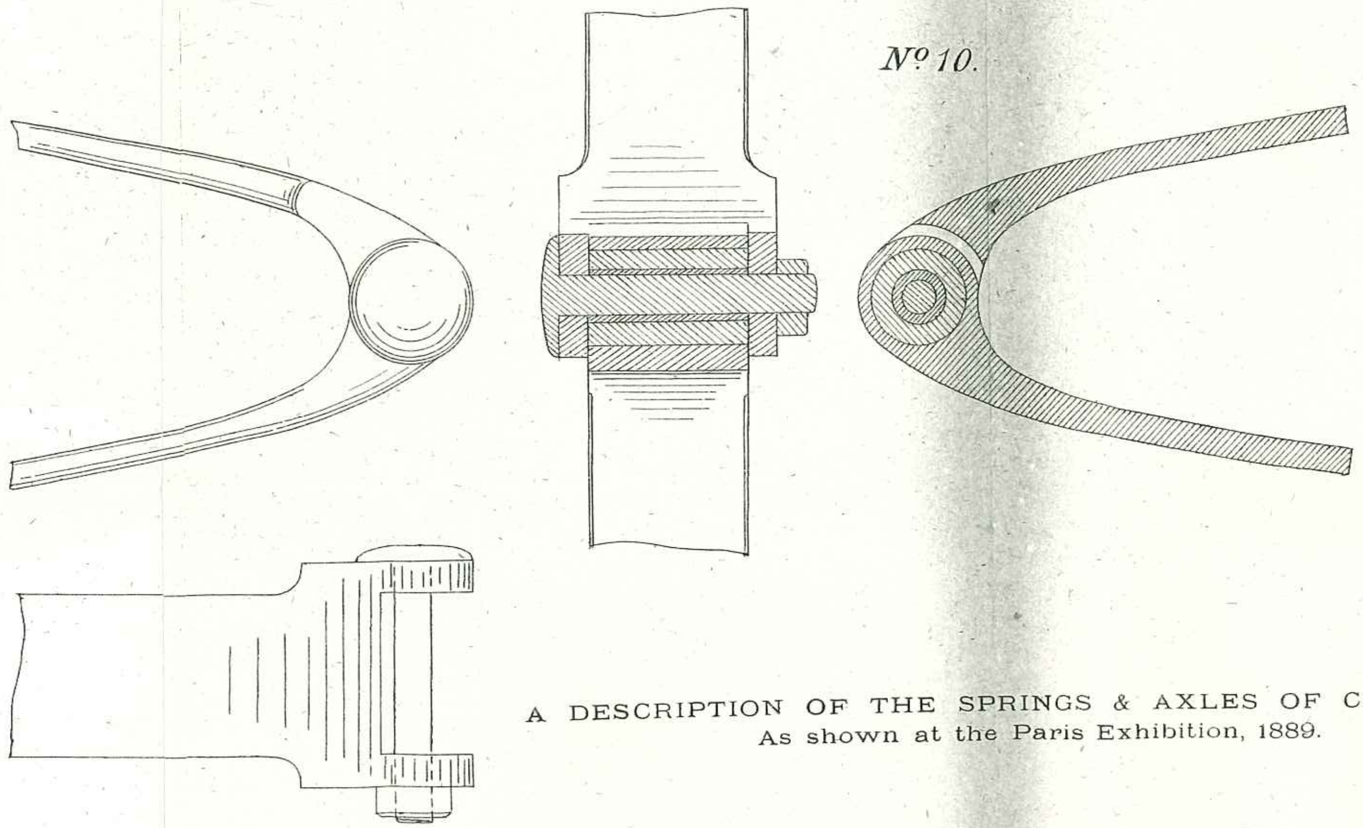
Nº 9.



Nº 8.



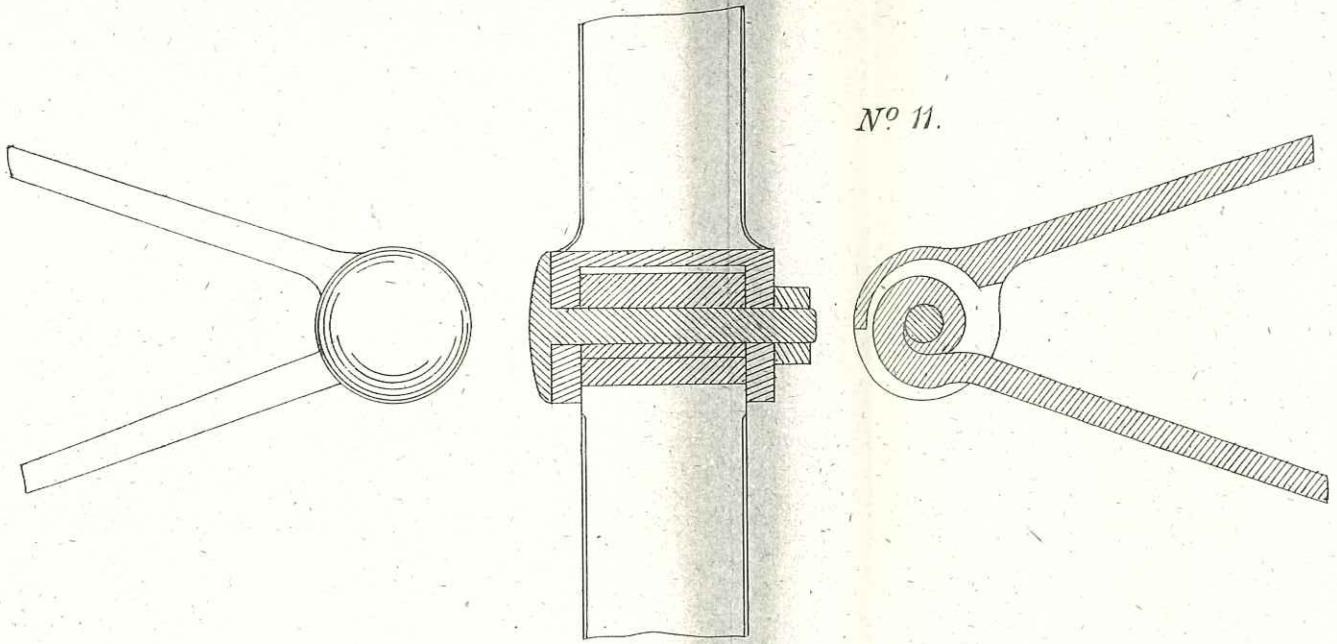
Nº 10.



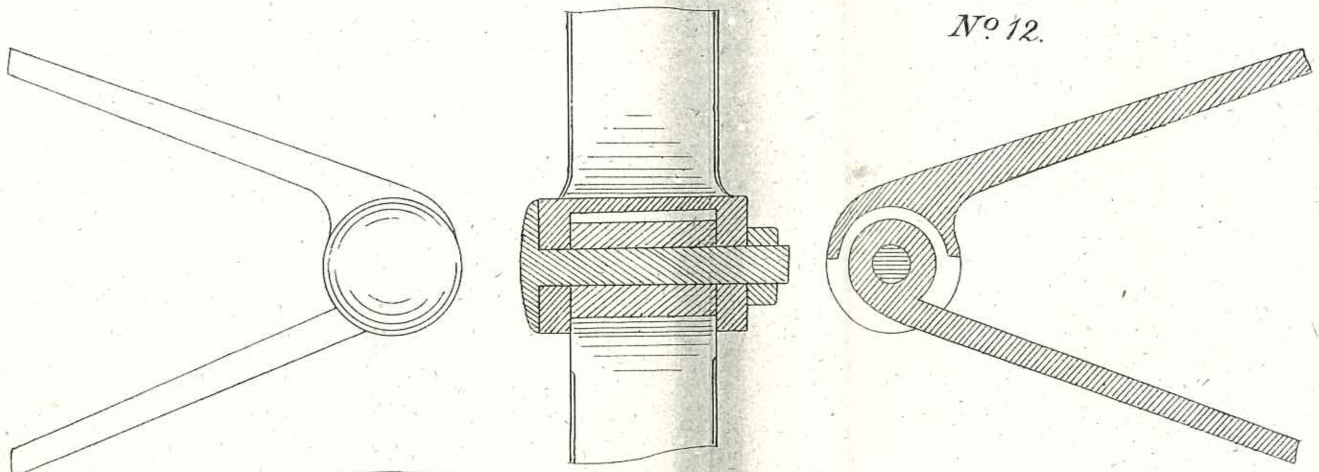
A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

Lithographed by JOHN KEMP & Co.

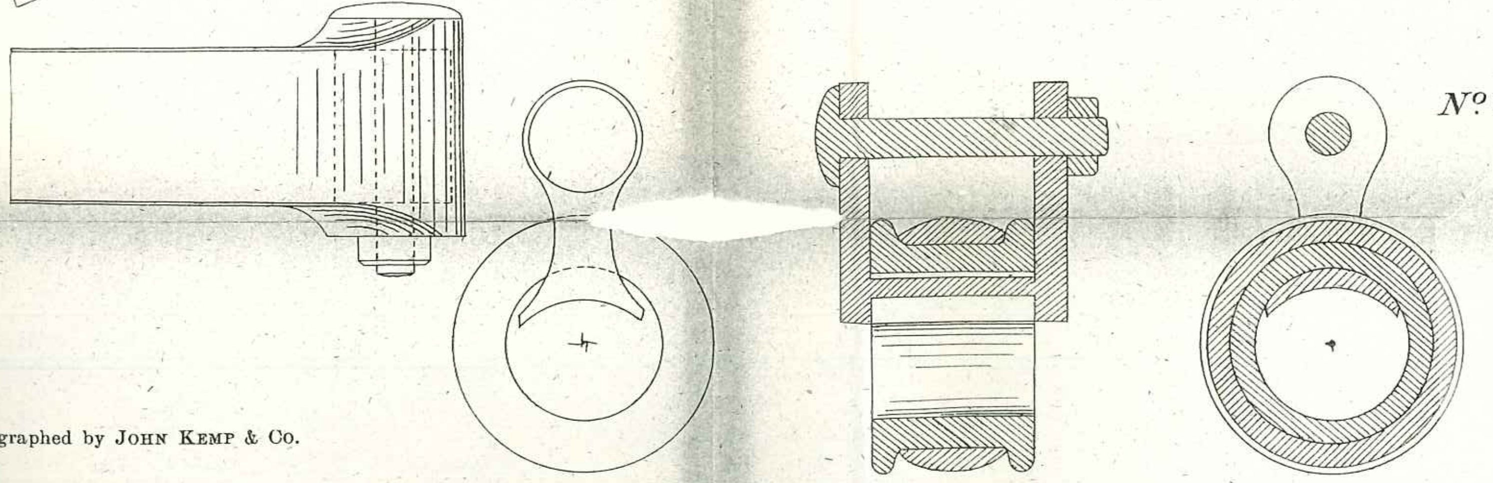
SHEET 2.



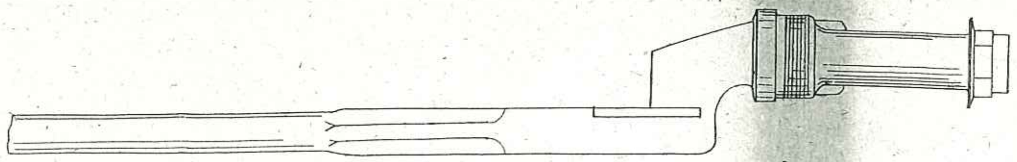
Nº 11.



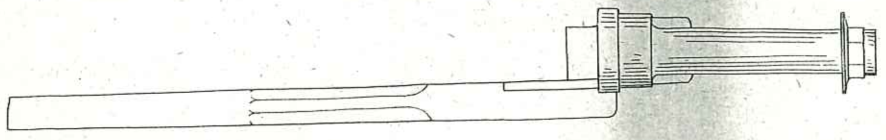
Nº 12.



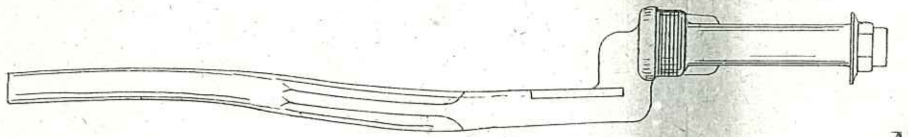
Nº 13.



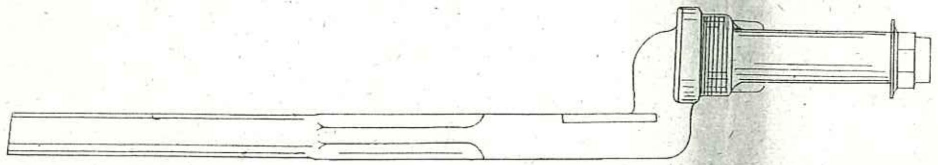
Nº 14.



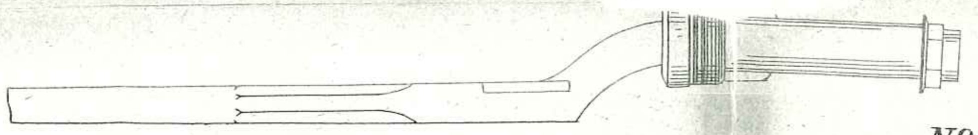
Nº 15.



Nº 16.



Nº 17.

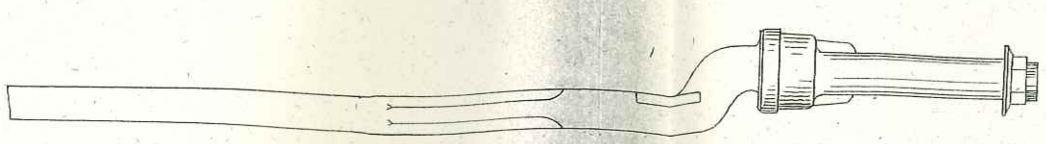


Nº 18.

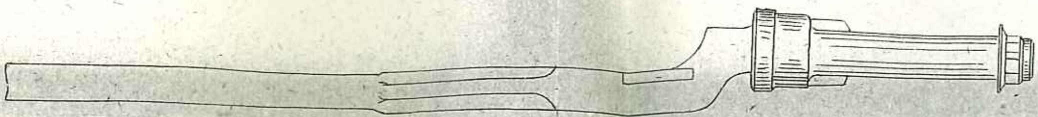
Lithographed by **John Kemp & Co.**

SHEET 3.

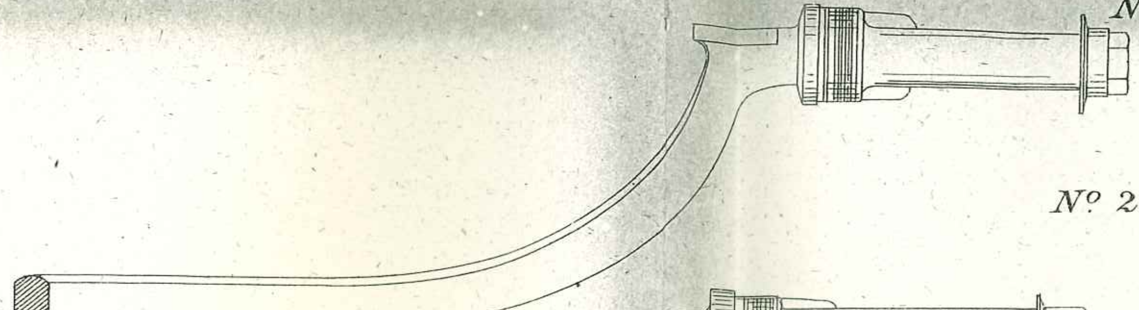
A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.



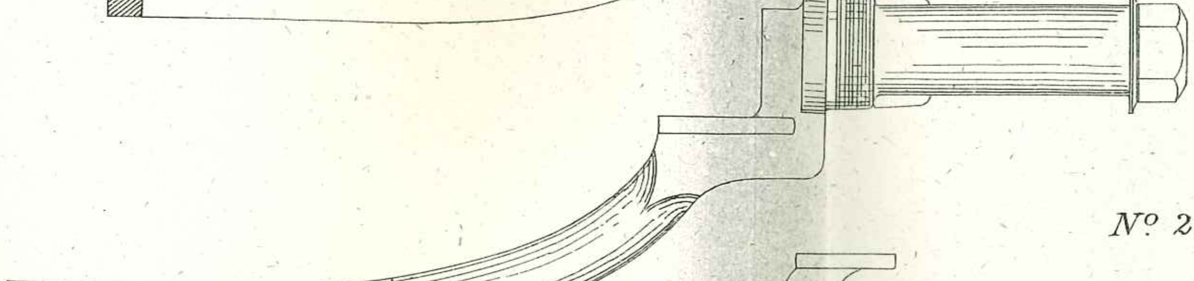
Nº 19.



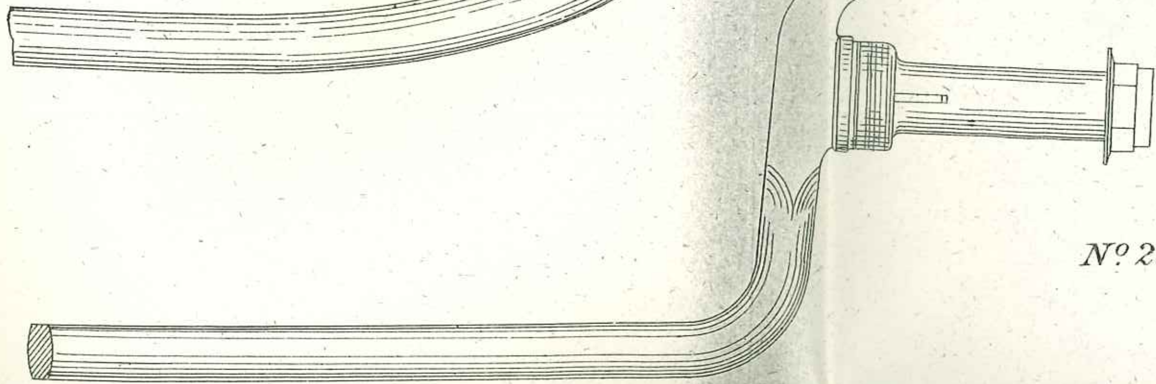
Nº 20.



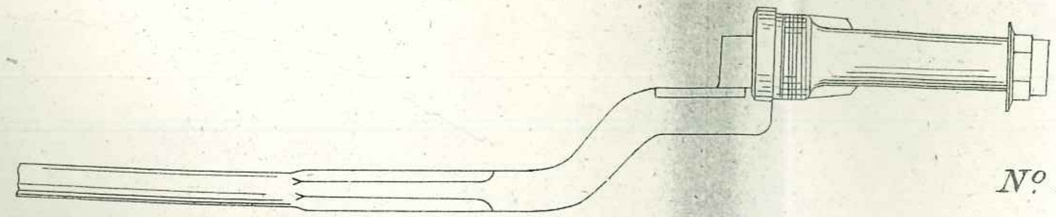
Nº 21.



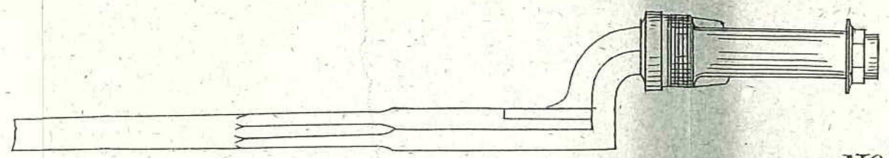
Nº 22.



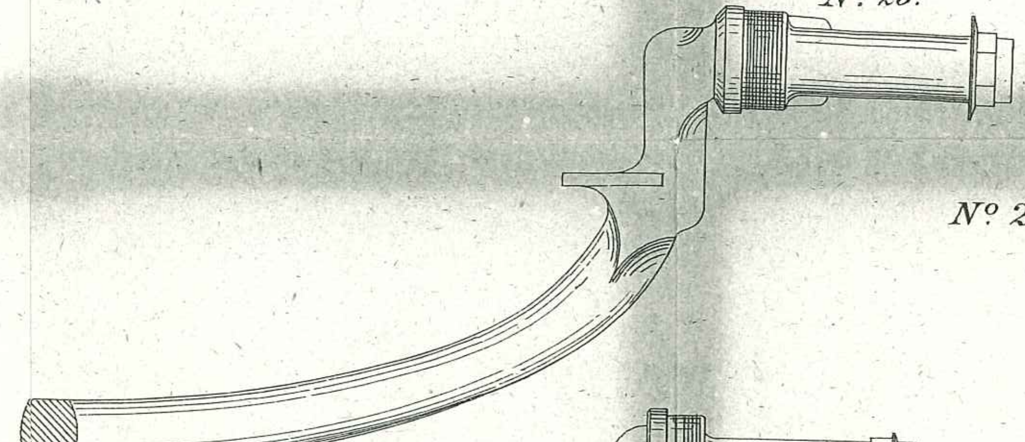
Nº 23.



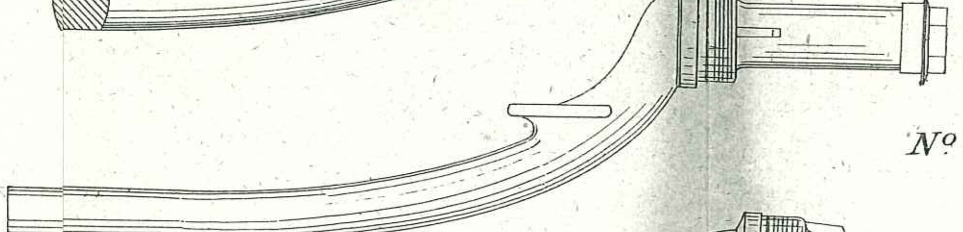
Nº 24.



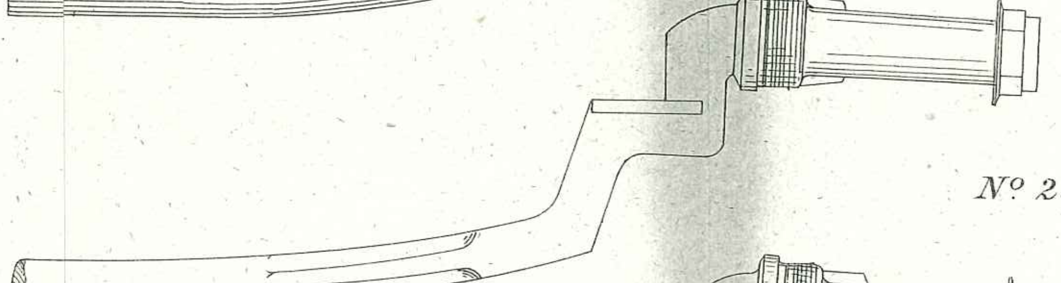
Nº 25.



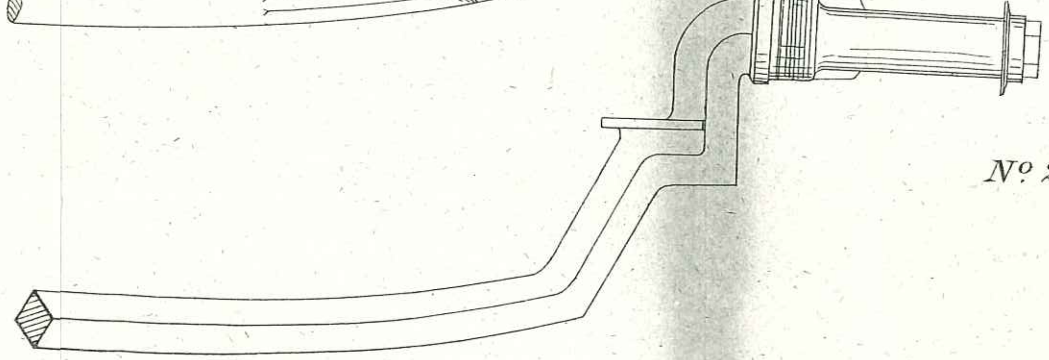
Nº 26.



Nº 27.



Nº 28.

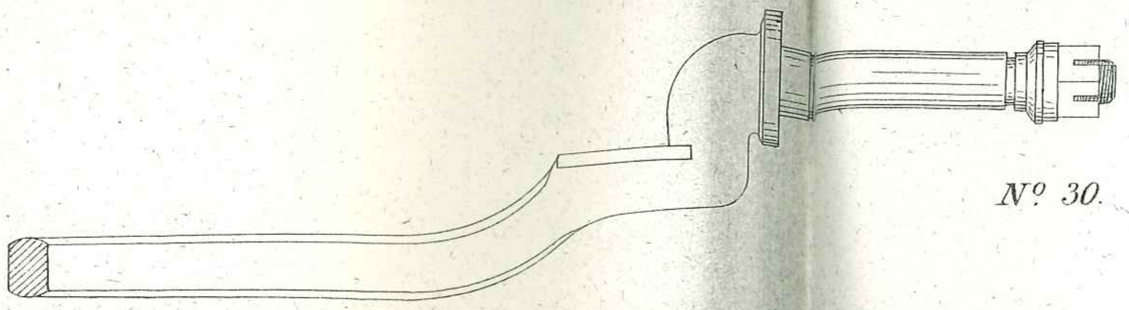


Nº 29.

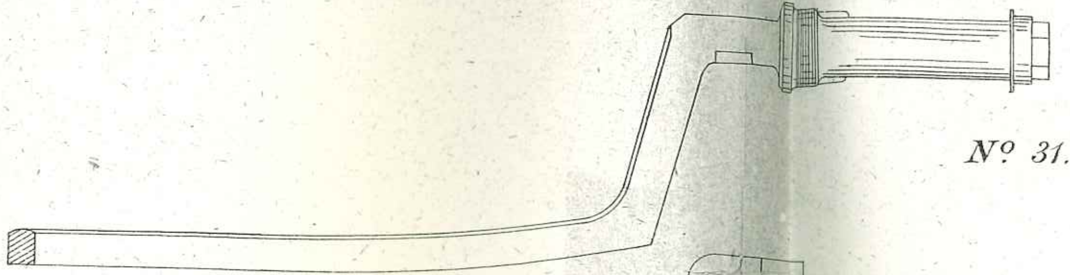
A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

Lithographed by John Kemp & Co.

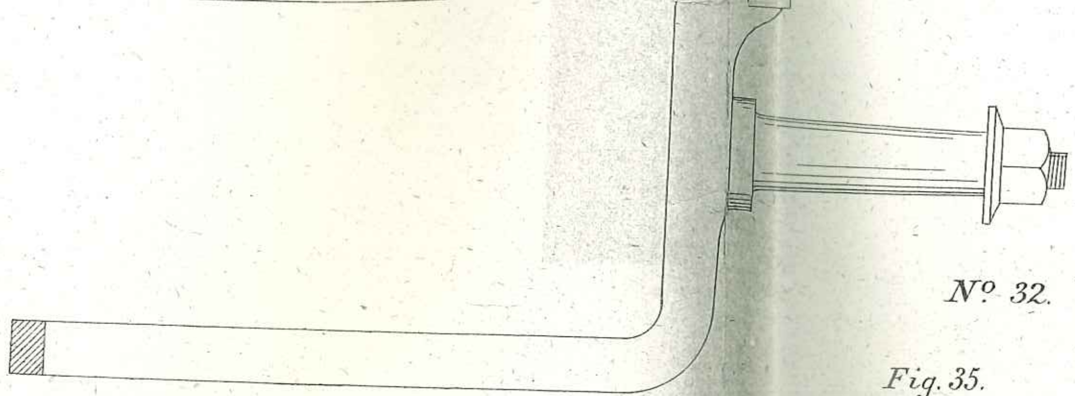
SHEET 4.



Nº 30.



Nº 31.



Nº 32.

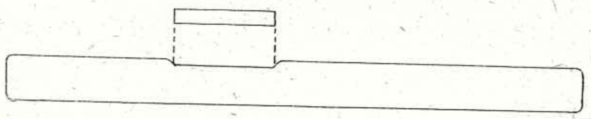


Fig. 33.

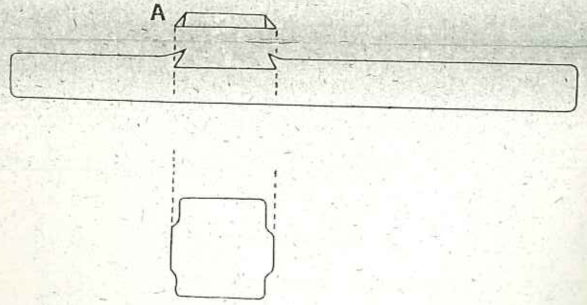


Fig. 34.

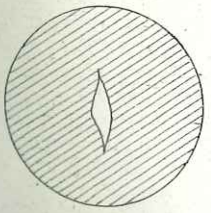


Fig. 35.

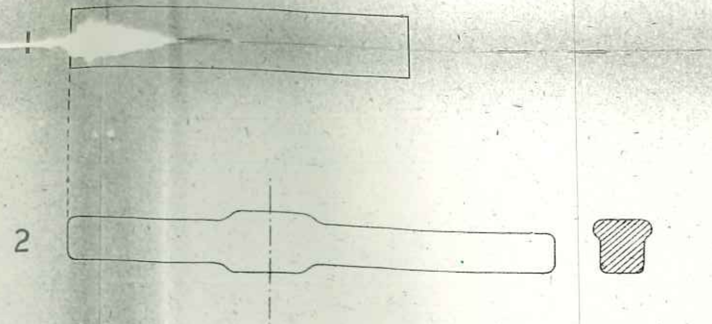


Fig. 36.

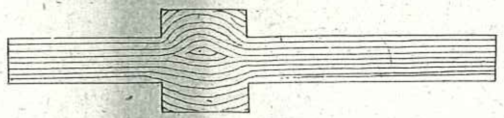


Fig. 37.

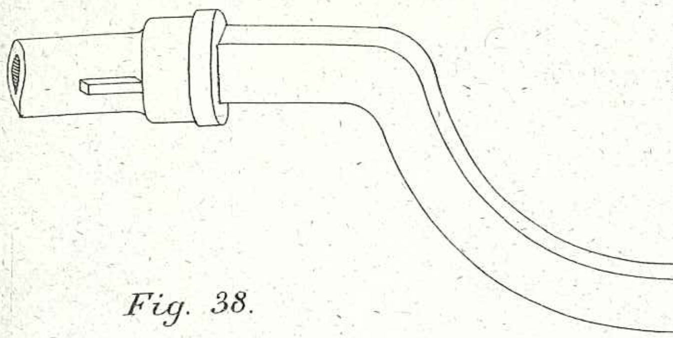


Fig. 38.

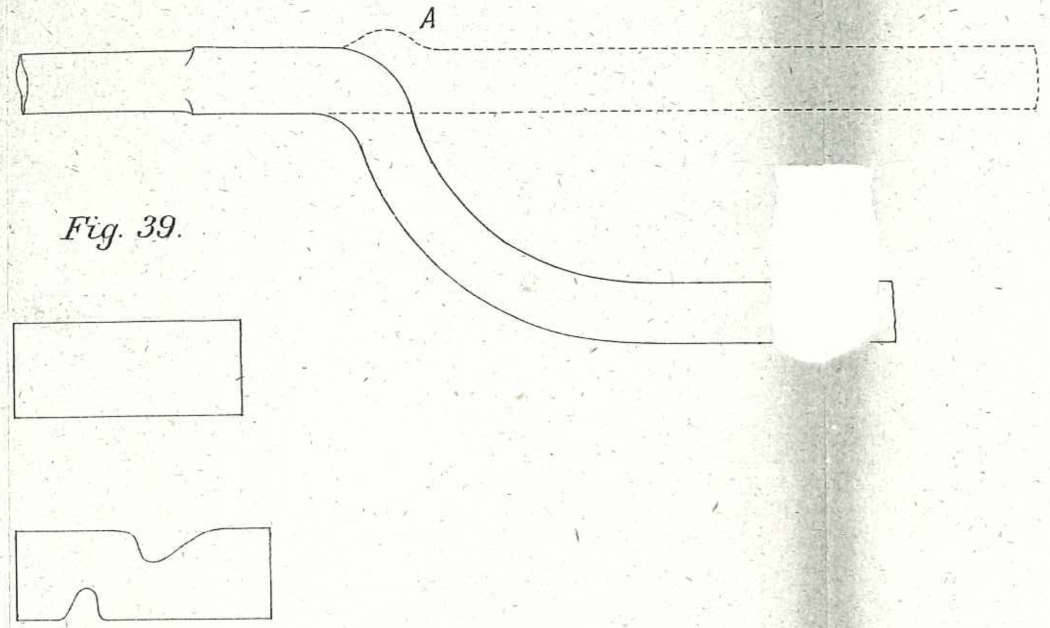


Fig. 39.

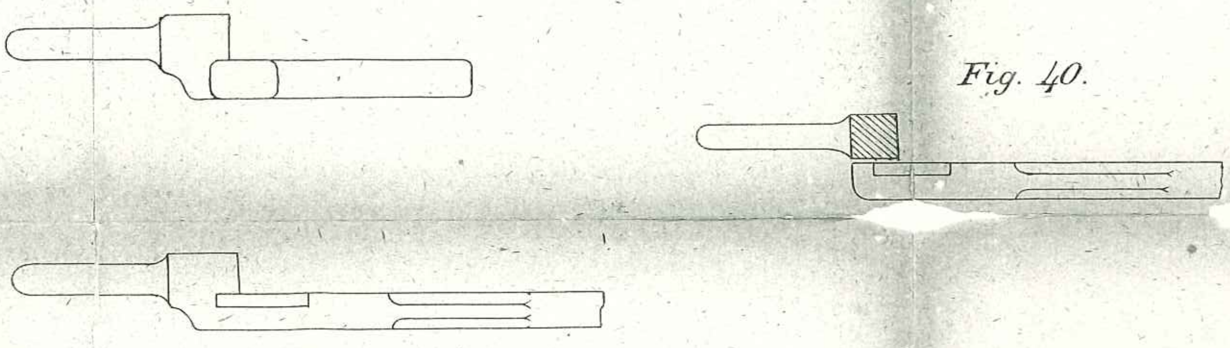


Fig. 40.

SHEET 5.

A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

Lithographed by JOHN KEMP & Co.

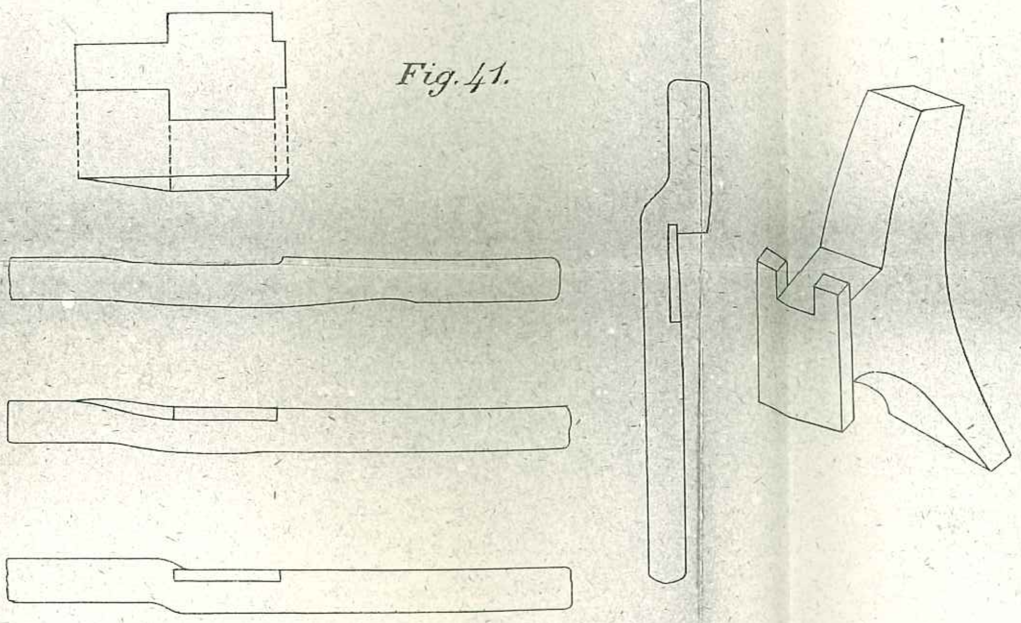


Fig. 41.

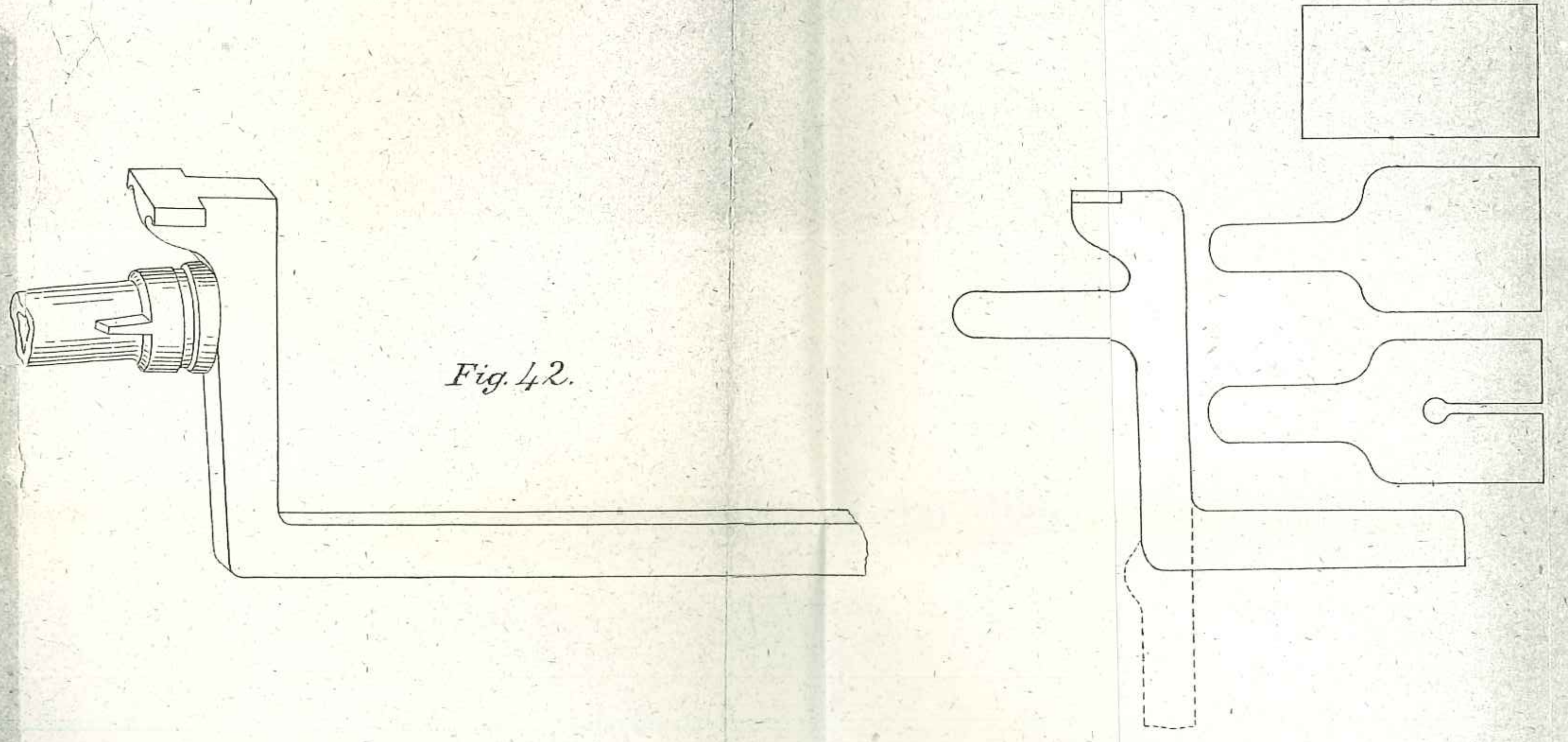


Fig. 42.

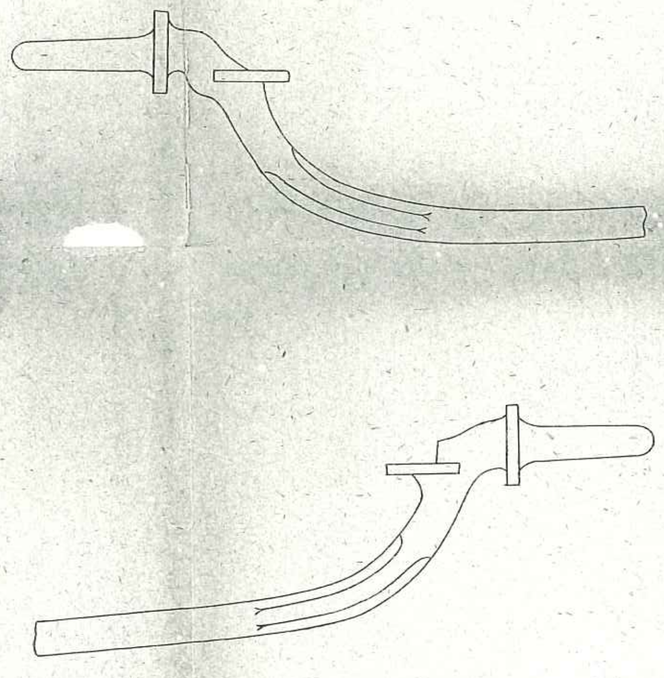


Fig. 43.

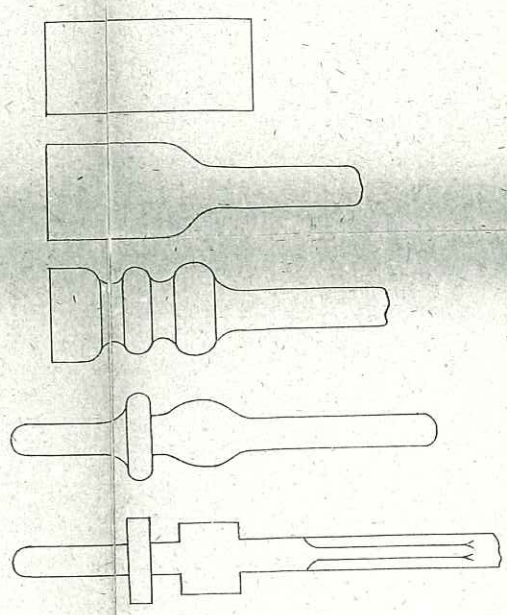


Fig. 44.

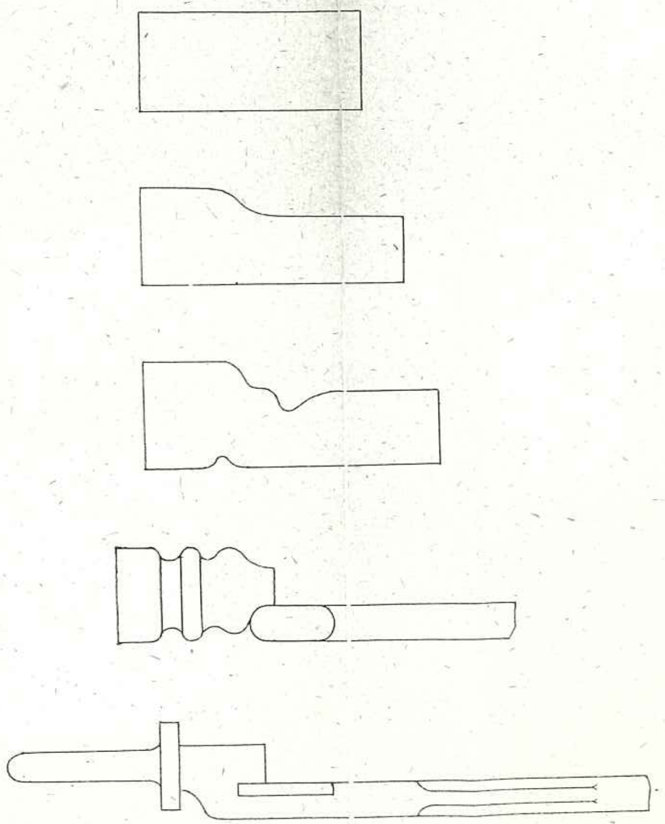


Fig. 45.

Lithographed by John Kemp & Co.

A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

SHEET 6.

Fig. 27.

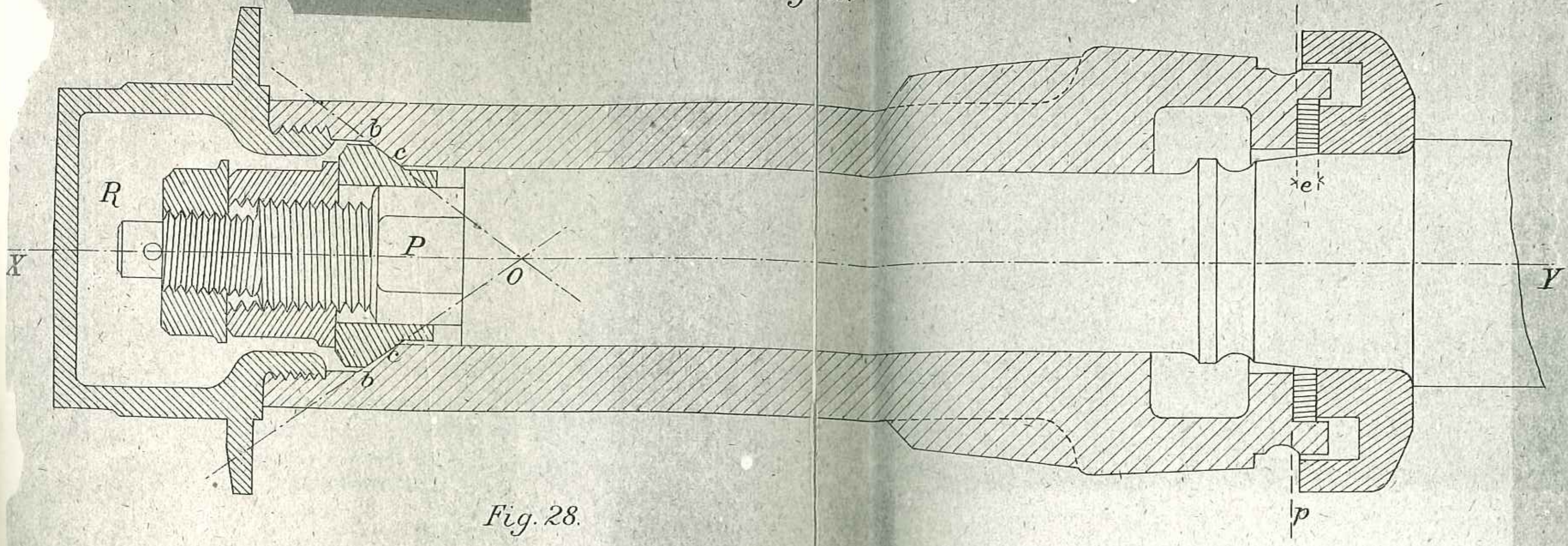


Fig. 28.

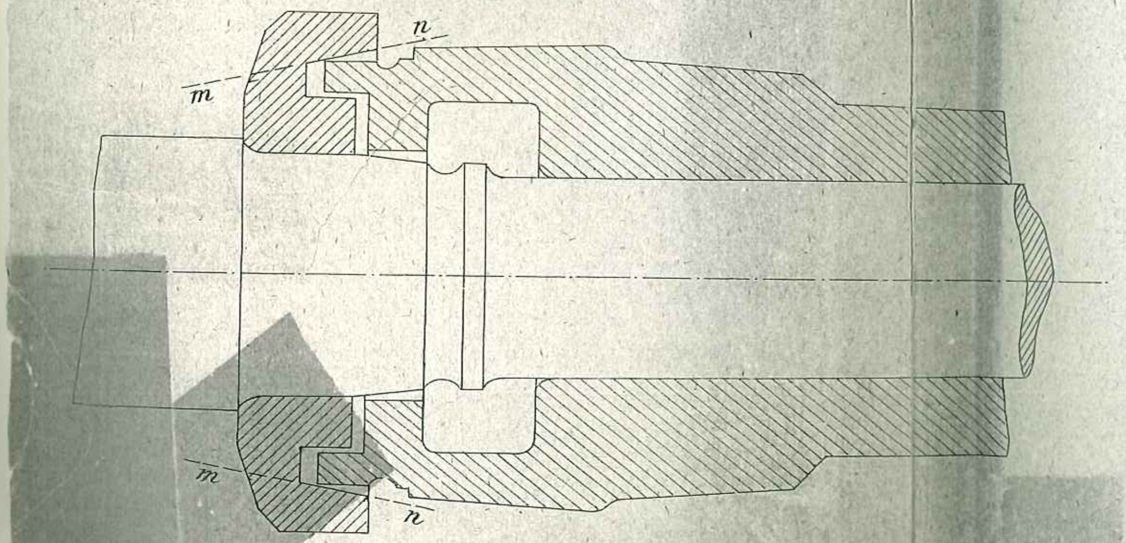


Fig. 29.

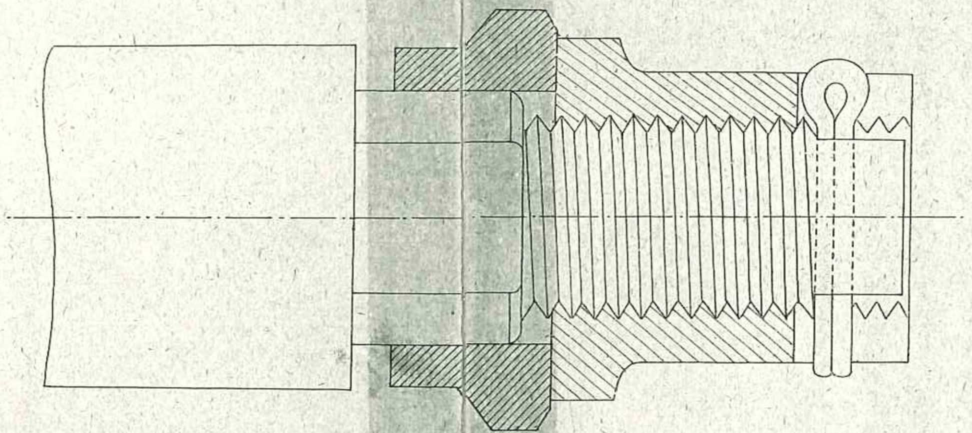


Fig. 30.

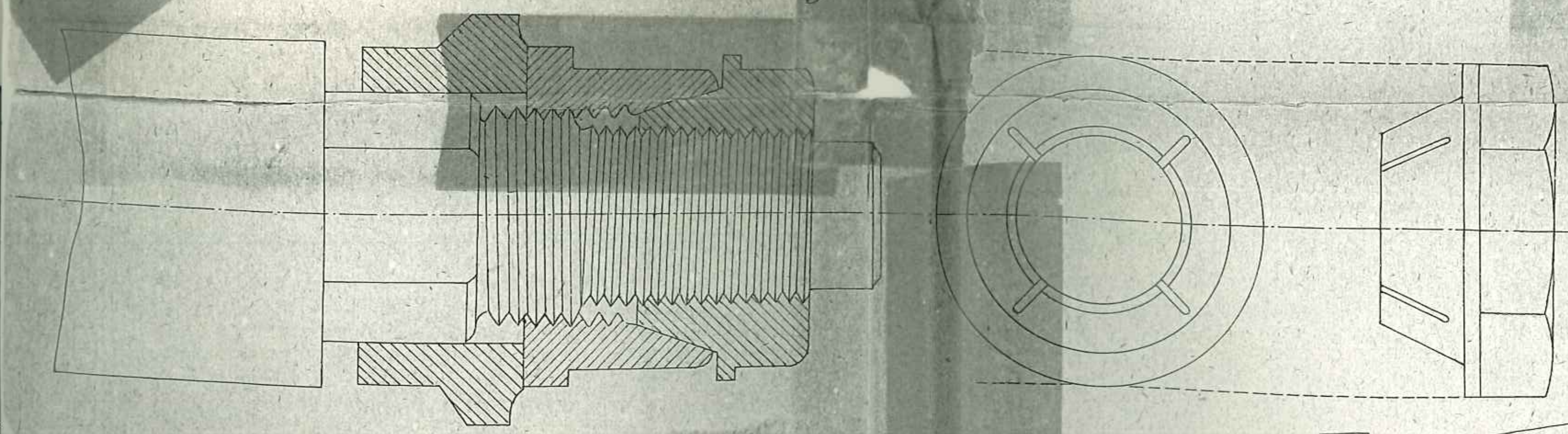


Fig. 31.

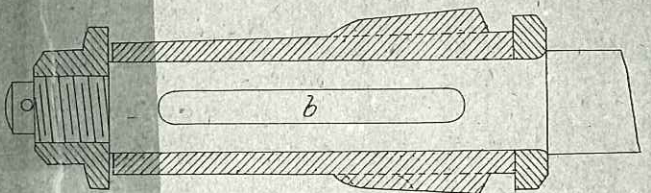


Fig. 32.

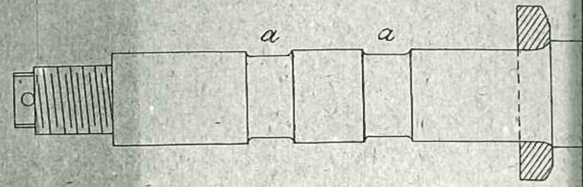


Fig. 33.

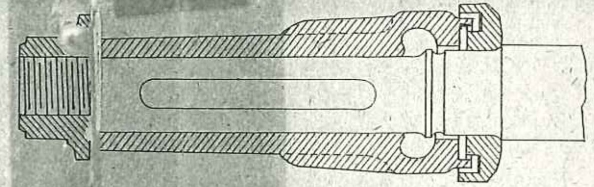
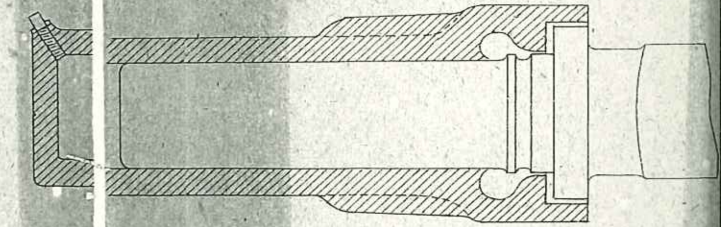


Fig. 34.



Machine à essayer les ressorts

Fig. 35.

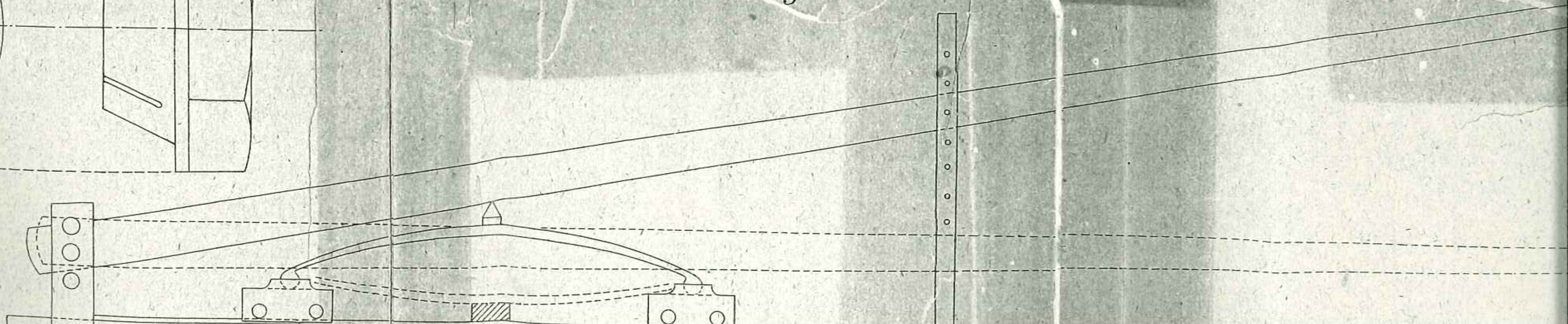


Fig. 27.

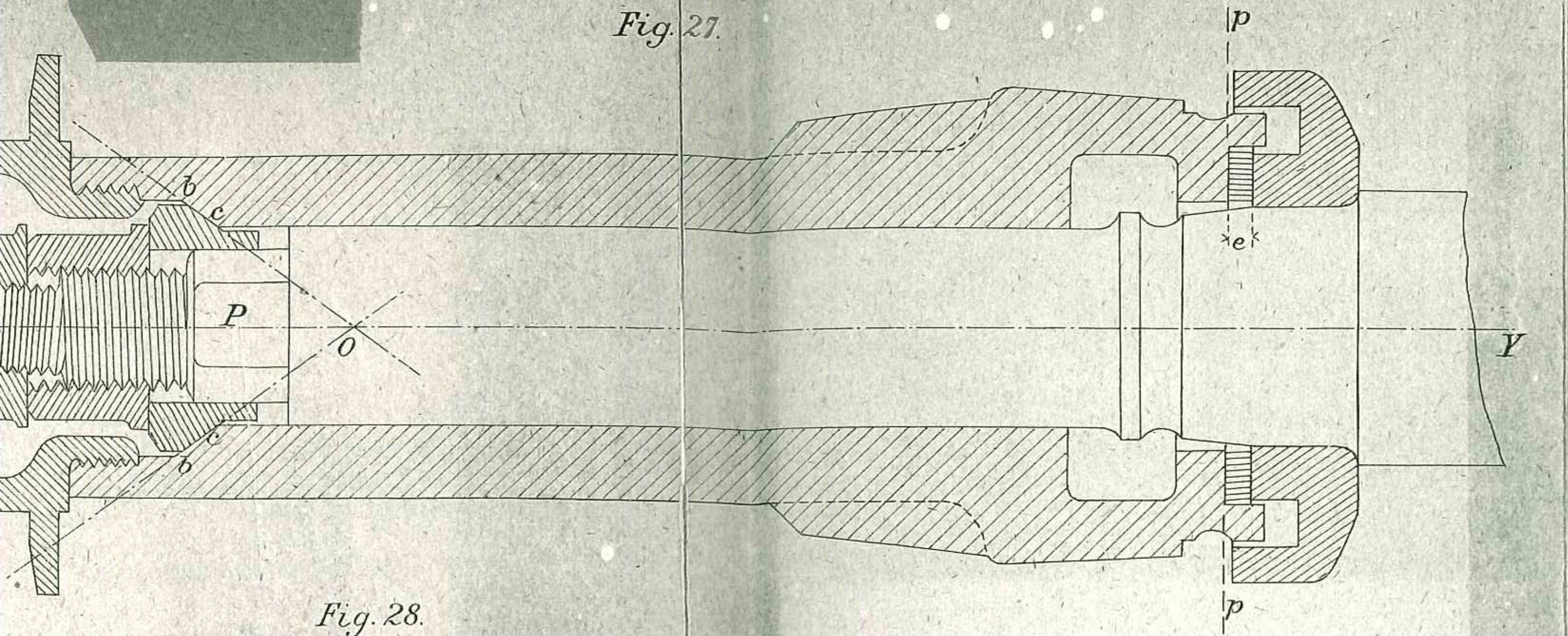


Fig. 31.

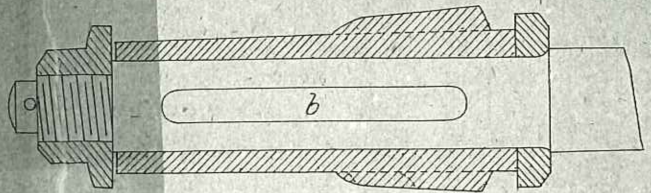


Fig. 32.

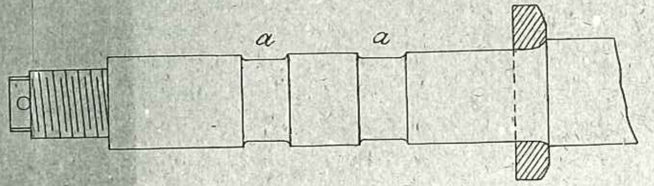


Fig. 33.

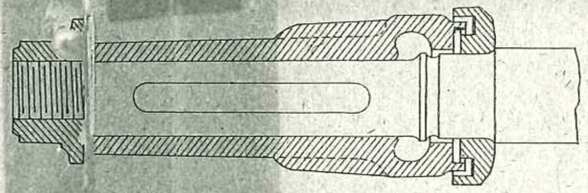


Fig. 28.

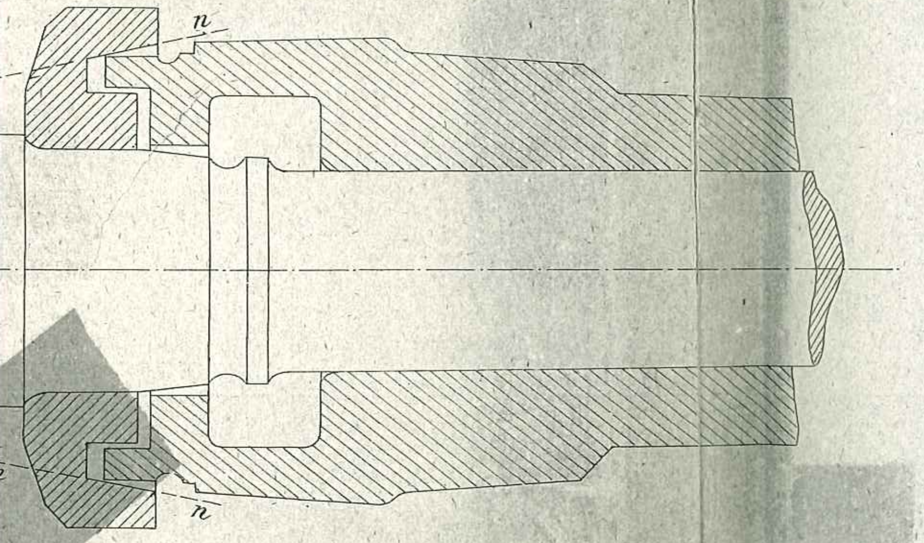


Fig. 29.

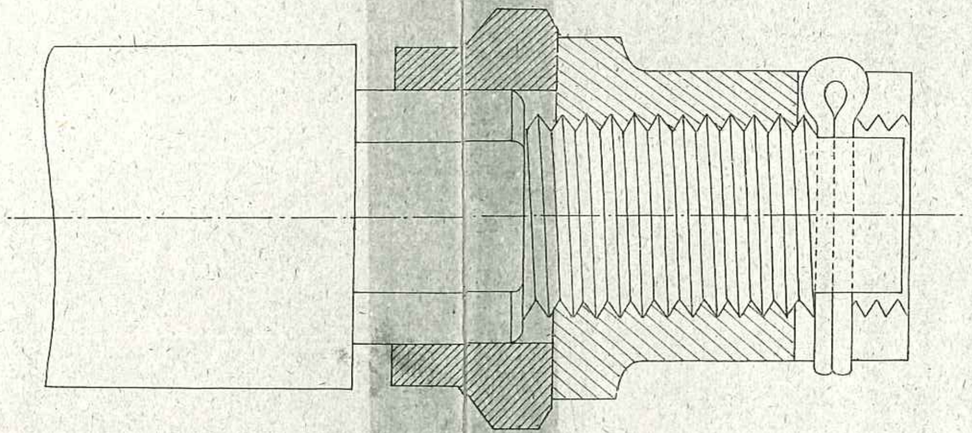


Fig. 34.

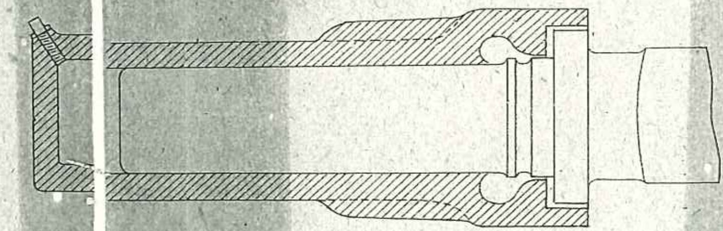
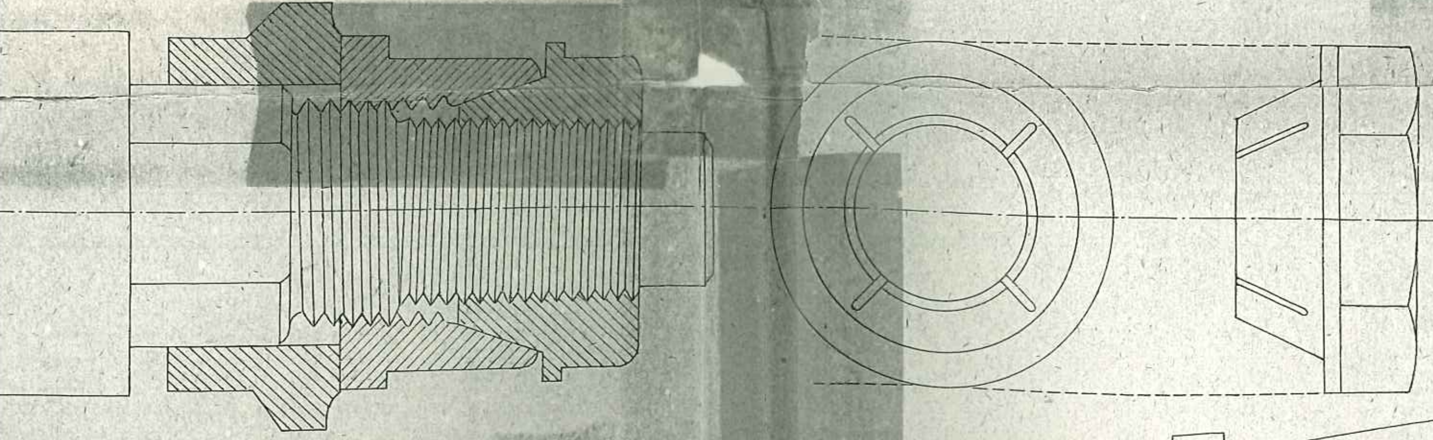
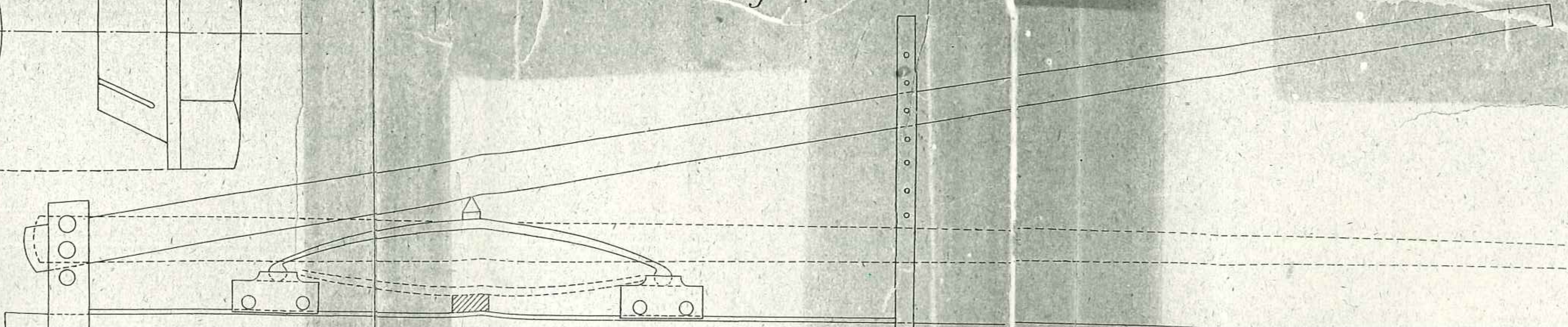


Fig. 30.



Machine a essayer les ress[illegible]

Fig. 35.



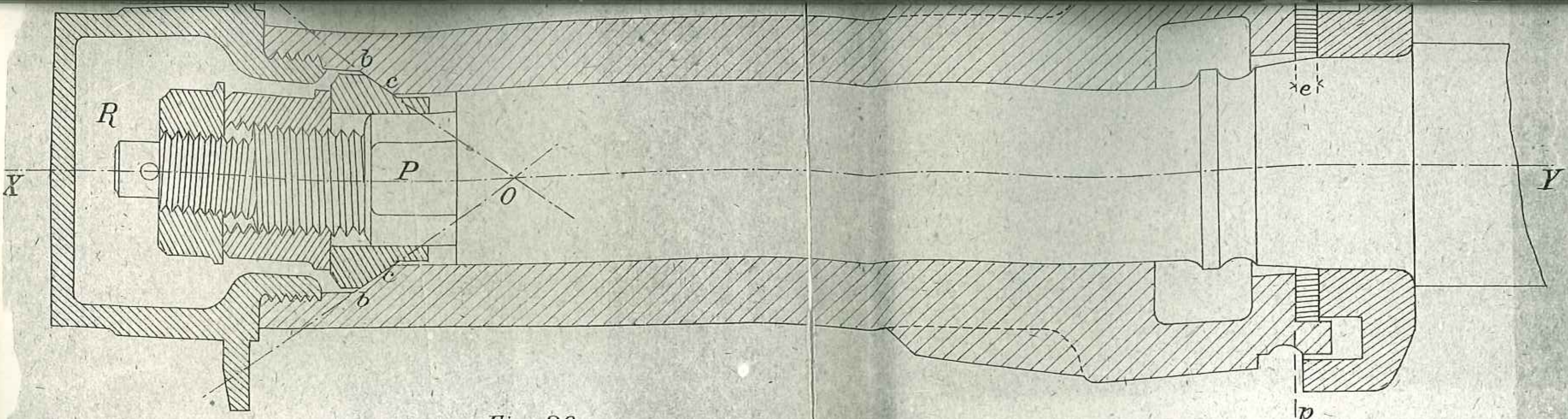
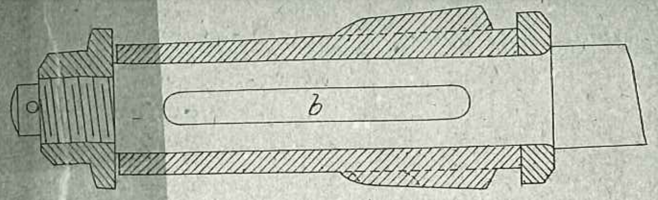


Fig. 28.



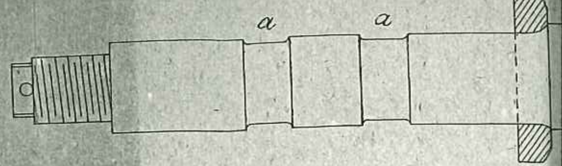


Fig. 33.

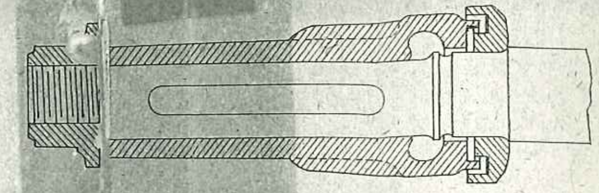
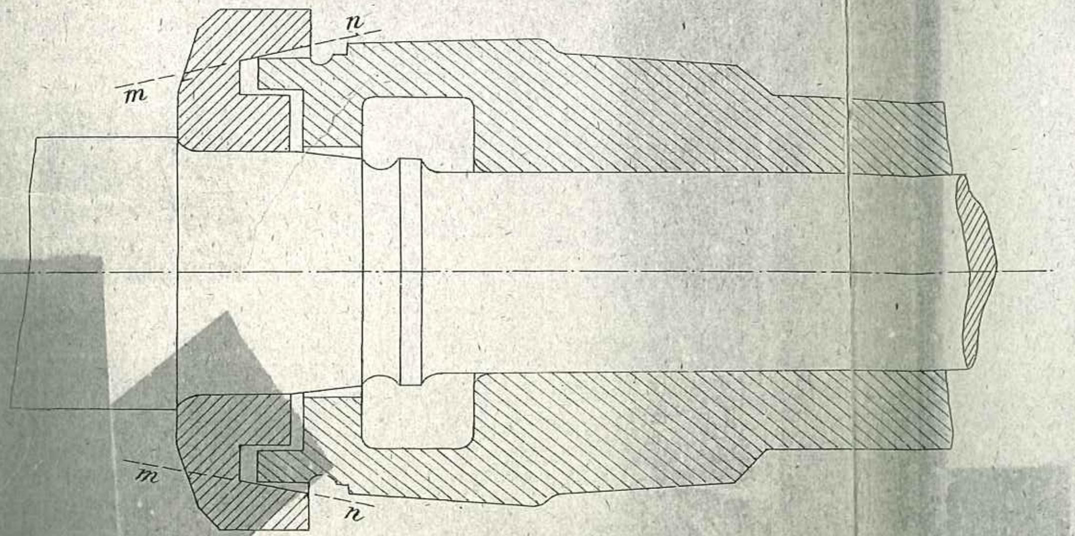


Fig. 29.



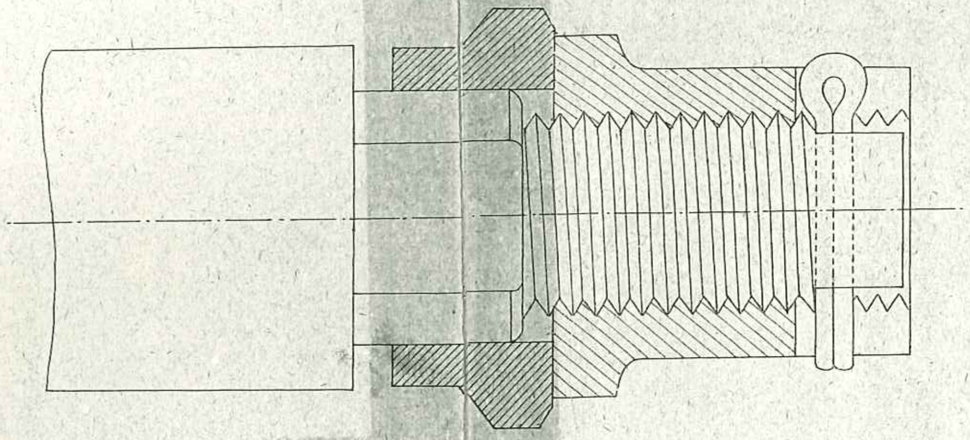


Fig. 34.

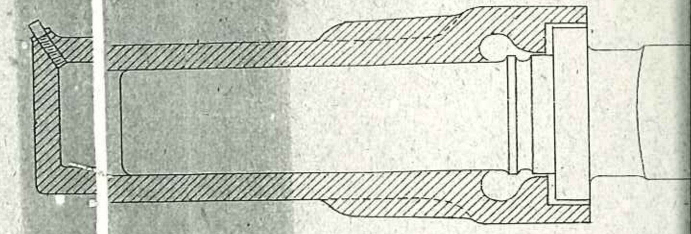
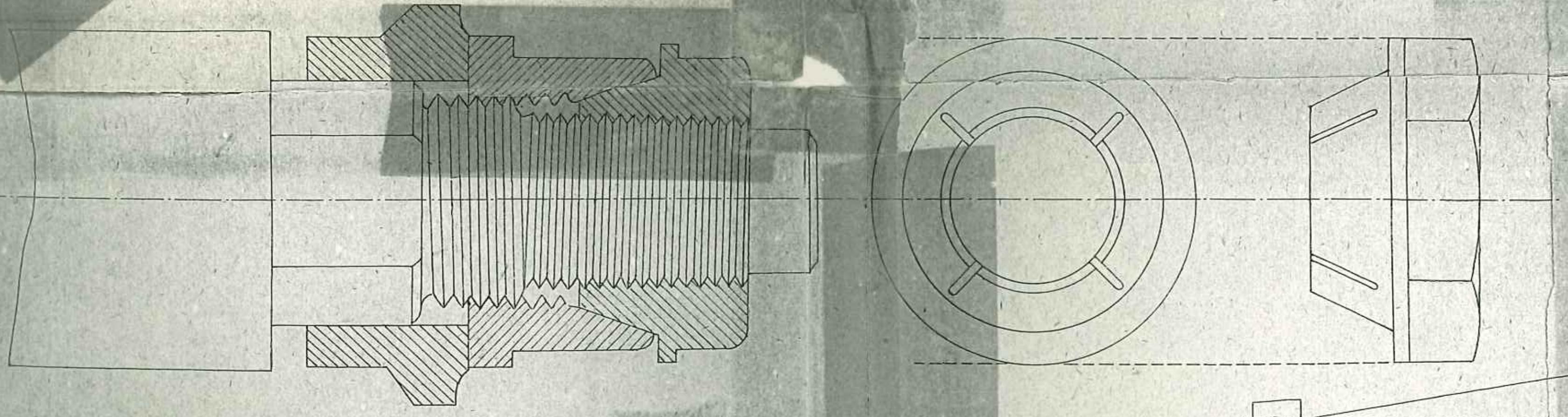
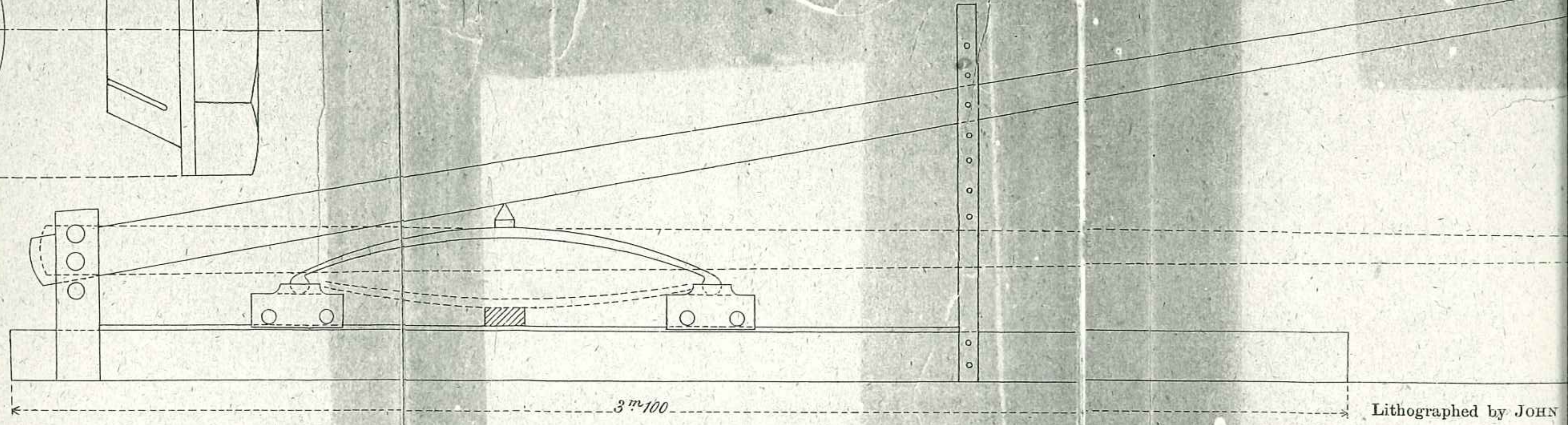


Fig. 30.



Machine a essayer les ressorts

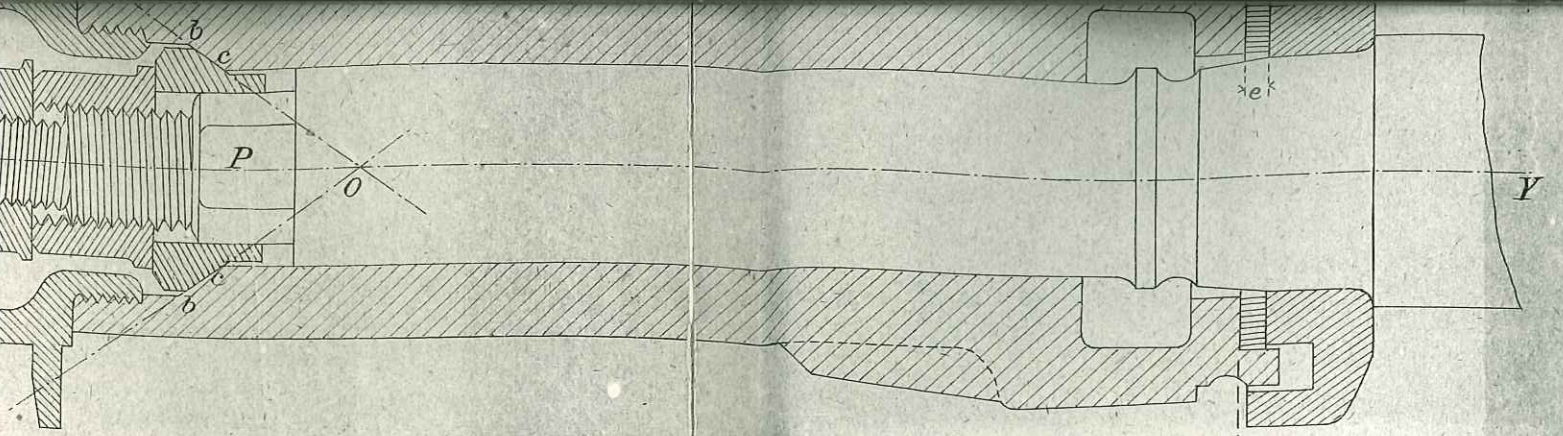
Fig. 35.

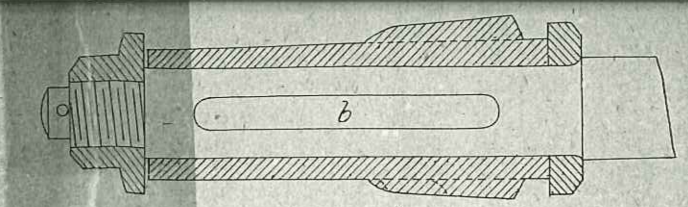


A DESCRIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

SHEET 7.

Lithographed by JOHN





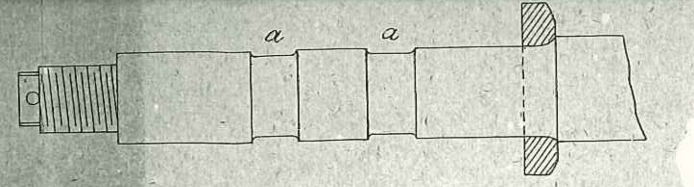


Fig. 28.

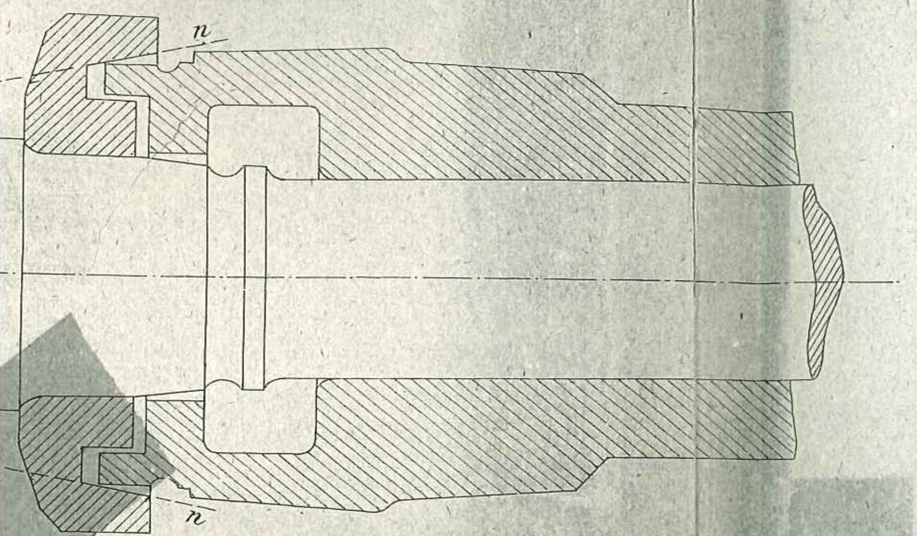


Fig. 29.

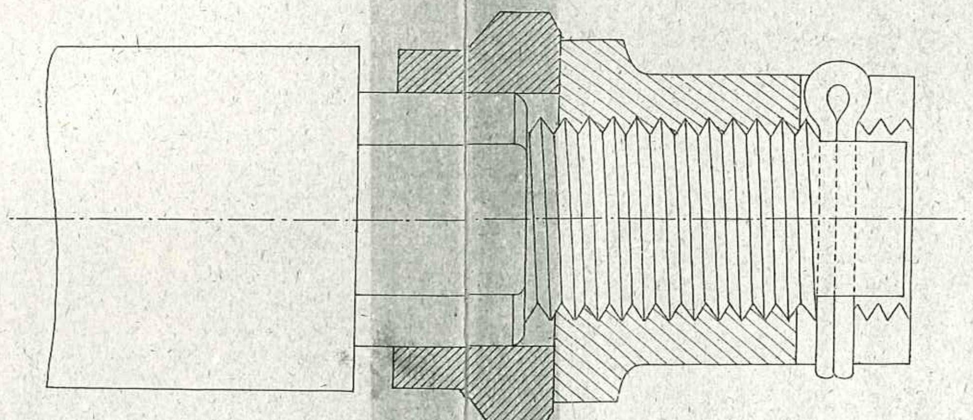


Fig. 33.

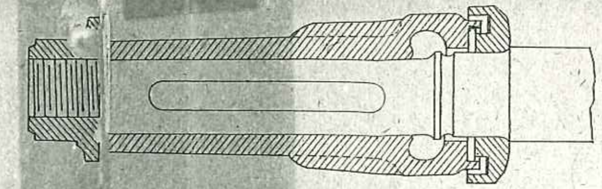


Fig. 34.

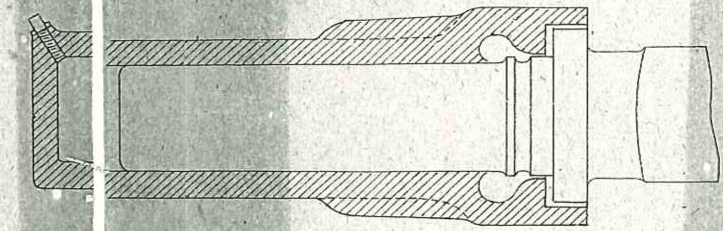
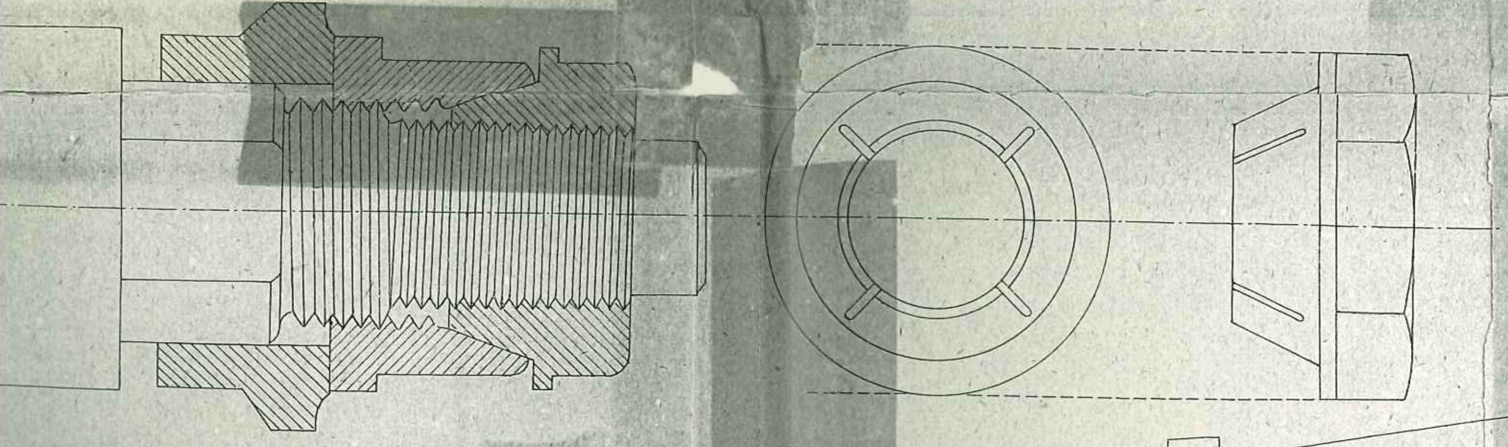
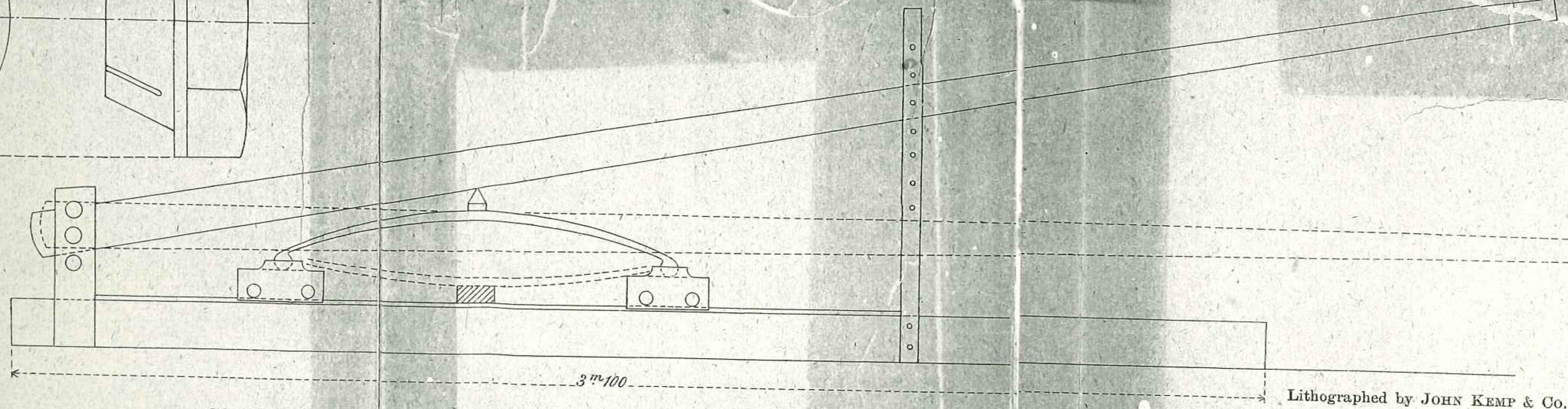


Fig. 30.



Machine a essayer les ressorts

Fig. 35.



RIPTION OF THE SPRINGS & AXLES OF CARRIAGES
As shown at the Paris Exhibition, 1889.

SHEET 7.

Lithographed by JOHN KEMP & Co.

This preservation photocopy was made
at BookLab, Inc. in compliance with copyright law.
The paper meets the requirements of ANSI/NISO
Z39.48-1992 (Permanence of Paper)

∞

Austin 1998

US PATENT & TRADEMARK OFFICE
3 0402 00130 4221

RARE

Philipson,
John

◆

Carriages-
1889
Exhibit

TS
2020
.P555